The New Zealand
Journal of Agriculture.

VOL. XXXII. WELLINGTON, 20th MARCH, 1926. No. 3.

THE CONTROL OF WEEDS.

PRINCIPLES AND METHODS.

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1. INTRODUCTION.

A WEED has been defined as a plant growing in the wrong place. Under such a definition an oat-plant in a wheat crop is a weed, and, conversely, a wheat-plant in an oat crop is likewise a weed. Such a definition from the farming standpoint is of very little value. In any consideration as to whether a plant is a weed or not, the character of the land, the use to which it is put, and the type of farm-management desired to be adopted have all to be taken into consideration. The main characteristic that determines whether a plant is a weed or not is whether it exercises a detrimental effect on the production from the farm. Generally speaking, it is the type of crop grown rather than the plant itself that is the determining factor. This only emphasizes the fact that the same plant may be a weed under certain conditions and not under others. For instance, fat-hen, often a bad weed limiting production in spring-grown crops, is never a weed either in autumn-sown crops or in established grassland.

Broadly expressed, land may either be used for the production of grass or the production of annually sown crops. In other words, a sharp distinction has to be made between arable land, regularly under the influence of tillage implements, and grassland, where tillage implements other than the chain or tripod harrows are not ordinarily used during the life of the pasture. Grassland itself, however, varies in duration from only a few years, when the land is ploughed and resown with grass or used for a series of years for annual cropping, to truly permanent pasture never broken up either for grass-establishment or arable farming. These two great divisions of land-utilization for grass and annual-crop production naturally divide weeds into two classes—grassland weeds and annual-crop weeds. At times, however, the same plant may be both a grassland and an annual-crop weed, an outstanding example being Californian thistle; but even in this case the plant is a far more serious weed of arable land than it is of grassland. In addition to these two groups, consideration has also to be paid to weeds of certain special crops such as lucerne or cow-grass for

seed-production, crops that last more than one year but hardly come under either category. Orchard weeds, again, have to be separately considered.

Apart from land occupied by crops or by pasture, considerable areas of a farm may consist of land used neither for cropping nor grazing. This can be looked upon as waste land so far as production is concerned. Again, there are wide areas in a more or less unimproved condition, and, although they may be used to a certain extent for grazing, they are awaiting the expenditure of money or the adoption of special stocking-systems to bring them into an improved condition.

From the foregoing considerations one can outline a rough land-classification so far as weeds are concerned, as follows :—

(1.) Land devoted to the growing of annual crops—cereals, green feed, roots, and vegetables.

(2.) Land devoted to the growing of crops that last more than one year, such as lucerne, or orchards, where cultivation can be carried out in the established crop.

(3.) Land devoted to the growing of grass where no cultivation can be regularly adopted after establishment, classified as temporary, short-rotation, long-rotation, and permanent grassland.

(4.) Land used neither for cropping nor grazing — odd corners of farms, land too steep for stock, roadways, stockyards, drains, hedges, plantations, &c.

(5.) Land in an unimproved condition, the vegetation of which is either natural or has been brought about by the feeding and trampling of stock without any original cultivation or sowing. This type is divided into two main classes. The first is where special methods—drainage, burning, and sowing, combined with stock manipulation—are necessary to bring the land into production, such as swamps, unburnt forest, and fern and scrub. The other type is where perhaps no special methods will ever be made to improve the carrying-capacity other than by intermittent spelling of the country. The great example of this type of country is the tussock and mountain-run country of the higher elevations of the eastern part of the South Island.

With this preliminary introduction it becomes possible to give some definitions of what are really weeds under the various methods of soil-utilization.

(1.) On arable land occupied by annually sown crops any plants other than those of the crop sown can be classed as weeds. The same definition can be applied to any plants other than lucerne that occur in a lucerne crop.

(2.) On grassland, both intentionally sown and natural, plants of very low feeding-value which tend to spread rather than decrease, and occupy land that is capable of producing on an economic basis plants of higher feeding-value, can be considered weeds.

(3.) On land that is used neither for cropping nor grazing, plants that are certain to spread and limit the production from adjoining arable land or grassland, unless controlled, can be looked upon as weeds.

(4.) On unimproved ground that is later going to be taken in hand and improved, those plants any increase in which will greatly increase the difficulty and cost of improvement come under the category of weeds.

It has been mentioned that the main characteristic of a weed in farming practice is that it exercises a detrimental effect on the production from the land it occupies, or is likely to limit production in the future. So far as actually affecting production is concerned, a very great deal depends on the quantity of the plant that may be present. In most cases, no matter what the plant may be or what are its potential possibilities, the farmer does not consider the plant to be a weed unless it is in sufficient quantities to necessitate clearly some special action on his part other than customary stocking and cultivation methods.

There are, however, some important exceptions to that general rule. Certain plants throughout New Zealand are looked upon as serious weeds, irrespective of whether they are rare or plentiful. Blackberry is rightly the outstanding weed in this respect over its climatic range. There are others, again, that are rare in certain districts and widespread in others. In the districts where rare their presence is viewed as demanding the immediate application of eradication methods; but where plentiful they are tolerated, and in many cases no attempt at control is made. Californian thistle, foxglove, and ragwort are notable plants in this respect. Again, certain plants that may be abundant on waste and unoccupied land are viewed as serious weeds through the quite unnecessary fear that they will spread and cause great damage. Fennel, for instance, so abundant on certain unoccupied land, and even included in the Third Schedule of the Noxious Weeds Act, but never under any circumstances found on grazed or cultivated farm-land, is often viewed as dangerous.

There are, however, weeds which even when present in small amounts are serious, inasmuch as they cause a reduction in the saleable value of the crop, or are likely to injure live-stock or live-stock products. Dodder, watercress, and hemlock are typical examples. The first greatly lessens the value of clover-seed; the second taints milk badly; and the third, if eaten freely by stock, causes mortality. Apart from these special weeds, such as poisonous and milk-tainting plants, it is the liability of any plant undesired on the farm to increase to such an extent that the ordinary accepted method of cropping or stock-management will have to be changed or modified which really determines whether special action must be taken or not. "Dirty" is the regular term applied to farms, whether pastoral or cropping, where special methods of weed-control have to be carried out, and a "dirty" farm invariably means one the production from which is being seriously interfered with by undesirable plants.

"Dirty" farms are, unfortunately, only too common in New Zealand, and in a series of articles, of which the present one forms the introduction, it is proposed to deal with the underlying principles involved in the cleaning of such farms, and the variations in method to be adopted with relation to soil, climate, crop, and possible management conditions.

(To be continued.)

Pasteurization in Cheese-factories.—Nine additional cheese-factories have installed milk-pasteurizing plants this season. It is expected that the quantity of cheese made from pasteurized milk this season will exceed 75 per cent. of the Dominion output.

NOTES ON CONTAGIOUS ABORTION IN DAIRY HERDS.

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THE season when abortions are most commonly observed among cows is now approaching, and the present is therefore a suitable time at which to remind farmers of what is known of this disease and of the means at their disposal to control it.

From the many thousands of blood-samples tested at the Wallaceville Laboratory it is safe to conclude that, with few exceptions, abortion among cows is due to the activities of Bang's bacillus—the specific microbe of contagious abortion. Farmers are all too ready to attribute the trouble to accidents, such as the animal having a fall or being chased by a dog. No doubt the wish is father to the thought, but it would be wiser to realize and face the truth. Accidental abortion is extraordinarily rare. If the calf is "slipped" following a fall, chasing, or overdriving, &c., it is almost invariably because of the ravages of the bacillus of contagious abortion in the womb—the act of abortion was pending, and the accident precipitated the event. Thus all cases of abortion must be regarded as contagious to other cows and treated accordingly.

There is no cure for this disease—a fact which must be stressed in view of the claims often made by vendors of patent medicines and cow-washes to induce farmers to buy from them. Vaccines have been used experimentally and otherwise for years, but as yet have not proved efficacious, and in some circumstances are positively dangerous. A particular form of vaccine, which at least has the merit of being harmless, inasmuch as it will not introduce the disease, is now being tested experimentally by the Department, and if results warrant it a further and much more extensive trial will be made next season. However, even should it prove useful, it will never be more than an aid to other methods of prevention and control.

All pregnant cows should be inspected frequently—not from a distance of a hundred yards or so, but closely, so that any abnormality may be discovered in its early stages. By this means a man who knows his cows can generally pick one that is going to abort in plenty of time to isolate her and avoid the main scource of infection to his other beasts—that is, soiling and infection of the pastures by the aborted fœtus, afterbirth, and subsequent discharges. A paddock should be kept for aborting stock, and they should remain in it till all discharges cease, which generally means four to six weeks. It is preferable to rig up a temporary bail in this paddock, and so avoid infecting the milking-shed; but where this cannot be done the aborted cows should be brought to the shed after the others have left, and after milking them the shed should be thoroughly flushed out and disinfected, the back-ropes and leg-ropes which have been used on them not being forgotten. The drainage from the shed should not be allowed to contaminate paddocks in which the cows are grazing. Aborted calves and membranes should be collected and burnt, and

the spot where they were found heavily dressed with quicklime. While in isolation the vaginal passage should be flushed out frequently with an antiseptic solution such as potassium permanganate and salt solution, or 1 per cent. lysol, Jeyes' fluid, Kerol, &c.

As far as is known at present, nothing further can be done during the actual abortion period. It is a common practice, when abortions have occurred, for the farmer to wash out each of the remaining pregnant cows, thinking thereby to avoid further cases. Very strong disinfectants are usually favoured. It seems highly desirable to emphasize here that such a practice is a useless waste of time. The infection, if present, is in the womb itself, which, during pregnancy, is hermetically sealed off from the vagina, so that douching cannot reach the affected tissues. It therefore cannot do good, and, moreover, by causing the unfortunate beast to strain, may easily hasten abortion if the disease is actively present.

PRECAUTIONARY MEASURES.

While the foregoing outline embraces all that can be done while the cows are aborting, there are several other factors to be reckoned with in planning to control the disease for the future.

(1.) The bull: When the causal organism of the disease was first discovered it was generally supposed that it was spread mainly through service. Subsequently it was shown experimentally that ingestion of the microbe on infected pasture, &c., was most commonly the cause, and the bull's part in transmission was pushed into the background. At present, as a result of further experimental work and the close observation of sundry outbreaks, it appears that the bull may sometimes be blamed. He may harbour the bacillus in his own genital organs, or he may carry it from cow to cow mechanically. With this in view the following practices should be observed:—

No cow that has aborted should be served till at least two months have elapsed.

No cow which shows a vaginal discharge should be served till this has been overcome.

The bull's sheath should be flushed out after each service.

In every case where a new bull is introduced into a clean herd he should be tested for the disease before use is made of him.

(2.) The calves: Nearly all cows which have aborted continue to harbour the bacillus in the udder for some years. The milk often contains it in fair quantities, and thus it reaches the calves. Hence it is present in the fæces of calves fed on such milk, and for this reason calves should always be kept in a paddock by themselves, and not allowed in contact with the adult herd or heifers of breeding age.

Up to about nine months of age calves are not affected by this microbe, though after that they enter the most susceptible period of their lives. Consequently the principal danger from milk is via the calves' fæces, and by isolating them during the milk-feeding period no risk is run.

(3.) Carriers: As has been said, a cow may harbour the organism of contagious abortion in her udder for years and yet carry her calves full time and never be suspected. Nevertheless, many such cows

expel large numbers of the germs at calving-time and the succeeding days. Thus a beast which becomes affected is a potential source of danger to clean animals unless she is regarded as an aborter, irrespective of her calving-dates, and is treated accordingly. Similarly, a bull may harbour infection (as shown by blood tests) for years, and while from the point of view of this disease he may be harmless to such cows as are affected, clean cows and heifers should not be put to him nor allowed to run with him. In many herds where the cows are extensively affected the owners' experience is that their only serious losses through abortions are caused by their heifers and first-calvers, thus demonstrating the facts here stated — that cows remain carriers and are a source of danger to clean stock where proper precautions are not taken.

A frequent and disastrous mistake often made by farmers is to sell off aborting cows and buy in new ones. The folly of this practice is evident if the facts are realized. Cows do sometimes abort two successive calves, but it is not common for them to do so. Moreover, an aborted cow is no less likely to conceive at the next breeding season than any other cow. Hence, by selling them off, valuable assets are being more or less thrown away. Moreover, such cows may be bought into a clean herd where they will introduce the disease (being carriers) and cause great anxiety and loss. On the other hand, new cows bought in to replace aborters are highly likely to abort, thus doubling the original loss and incidentally keeping the disease in an active state on the premises.

Owners who have reason to believe that abortion disease does not exist in their herds should on no account introduce new members, either males or females, without assuring themselves that these animals are also clean. Desirable as it is to avoid buying in by rearing one's own calves, there are times when to buy in is essential. In such circumstances one or two courses is open to the purchaser: he may insist on the test for abortion (blood test) being passed before purchase is made, or, if this is not feasible, he can place his purchases in strict isolation till he himself has had samples of their blood tested. If his herd is clean and his new beasts give a positive reaction he will be well advised to get rid of the latter at once.

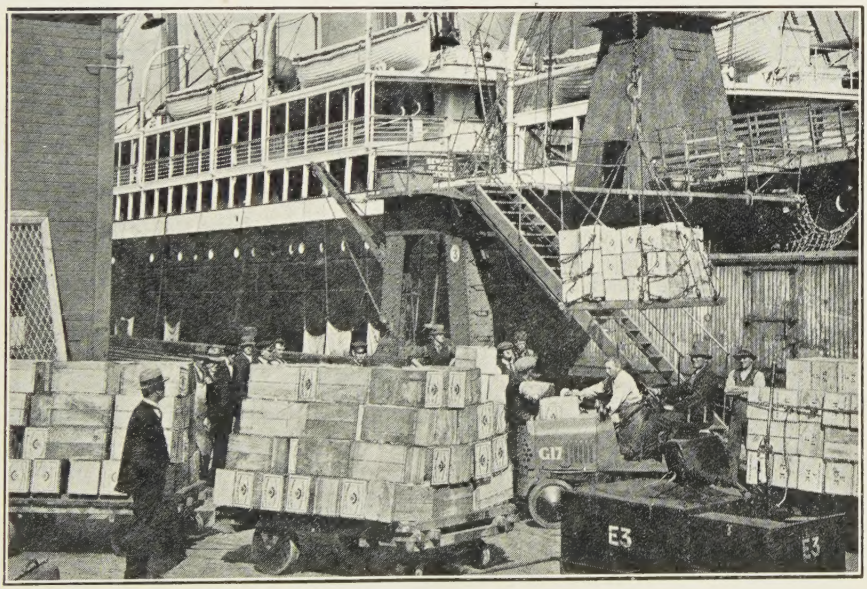
A question frequently asked by farmers who are troubled with abortion disease is, How long does the germ live on infected paddocks, &c.? It is generally considered that a period of three months is sufficient for its extermination. Actual experimental evidence that this is correct cannot be put forward, but from a knowledge of the organism's vitality and food requirements the period stated is felt to be adequate. In addition to leaving such paddocks as have been used for aborting and calving cows empty of dairy stock for three months after their purpose has been served for the season, it is a sound procedure to run a few sheep on them during that time. There is no fear of the sheep becoming affected, and they eat the paddock short, thereby greatly aiding in the cleansing process; moreover, they can be made to show a profit in place of the loss resulting from the paddocks lying idle. The three months' period being over, and the sheep disposed of, a good dressing of burnt lime will serve to make assurance doubly sure.

HOW TO SECURE AND FORWARD A BLOOD-SAMPLE.

In conclusion, a useful purpose may be served by a brief description of the simplest manner of securing a sample of blood from suspected cases. Appliances required are a pair of scissors, a sharp clean knife, a previously boiled 1 oz. bottle and cork, and a little Friar's balsam. Gather back the hair from the tip of the tail, and with the scissors clip away enough to bare the last inch of it. With the knife make a slit about $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long from above the tip and leading down to it. Blood will drip from this and can be caught in the bottle. Having filled the bottle at least half-way, cork it tightly, then pour a little of the balsam on the cut, pull the hair back in position, and leave the cow bailed up till bleeding ceases. A point worth noting is that having cut the tail it should be held very lightly in its normal position; a tight grip and a twisted tail will delay or stop the flow of blood.

Having satisfactorily collected the sample, it should be labelled to avoid any mistake and sent *with a covering letter* giving details of the case to the Veterinary Laboratory, Wallaceville, Wellington, where examinations are made and reports furnished without charge.

If an animal slips her calf and a blood test is required, the sample should not be forwarded till a fortnight has elapsed, as during that period the test made is not definite. During the interval between abortion and the receipt of the Laboratory report the case must, of course, be regarded as of the contagious type.



SHIPPING APPLES FOR EXPORT AT WELLINGTON.

TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1925.

W. M. SINGLETON, Director of the Dairy Division.

THE calendar year 1925 resulted in the issue of 806 certificates-of-record, as compared with 933 for the preceding twelve months — a decrease of 127 authenticated yields. It is a more or less natural expectation that the number of purebred cows entered for C.O.R. test each season will fluctuate, and not always increase from year to year. One possible explanation lies in the fact that many breeders test in advance of the rate at which their young stock is reaching the age for C.O.R. testing: that is to say, breeders entering cows for the first time will test all their eligible cows, and once tested there remains only the young stock coming on. As time goes on the number of new breeders on our lists decreases, and thus fails to offset the falling-off caused for the reason just mentioned.

So far as the statistics under review are concerned, however, the more likely explanation for the shrinkage is a decrease in the demand for purebred bulls with butterfat backing. Unlike the owner of an ordinary dairy herd used for the purpose of supplying a dairy factory, the breeder of purebred dairy cattle does not test so much for the purpose of grading up the average production of his herd as for establishing butterfat-record pedigrees, in order that he may develop a market for his surplus stock, and particularly for his bull calves. For the past two years or more purebred bulls have, on an average, brought prices that have been less encouraging to C.O.R. testing breeders. Dairy-farmers do not appear to have felt the same freedom as formerly in expenditure of money for the purchase of purebred butterfat-record bulls. This, in our opinion, is the principal reason for the falling-off in C.O.R. entries for the past year.

We feel sure, however, that this state of affairs is merely temporary, and that sooner or later the average dairyman will be compelled to realize not only the importance but the absolute necessity of paying more attention to breeding better dairy cows. This can be accomplished only by the use of a better class of bull than the average herd sire found in our dairy herds at present; but, in turn, the right bull must be a purebred selected on the basis of C.O.R. records. We regard the existing position as somewhat serious, and one which is not only an individual matter but of Dominion-wide importance. Neglect of this phase of the dairy industry must react unfavourably on our annual output of dairy-produce, and there is no need to emphasize the ultimate effect upon the pocket of the dairy-farmer as well as on the general economic position of the Dominion.

Judged on the basis of average production the 1925 figures must be considered satisfactory. Compared with the preceding year the average production for the Friesian and Ayrshire breeds has increased, while that for the Jerseys and Milking Shorthorns has decreased slightly. Climatically, however, the past year was by no means perfect from a

dairying point of view. The spring of 1924, at which period the cows whose records appear in this summary commenced their test, was somewhat dry, and continued so until about the end of December. The first three months of 1925, however, were considerably more favourable, particularly in Taranaki and the Waikato, and brought out a second growth of succulent pasture. The winter was mild generally, though very wet, but the spring of 1925 was not only again very dry in most parts but exceptionally harsh. Thus C.O.R. cows were under severe conditions at the beginning and end of their season—probably the periods when they required nature's help the most. These circumstances considered, the average production of 1925 must be accepted as more than satisfactory.

The outstanding record of the year is that of the Jersey cow Holly Oak's Annie, bred by Mr. John Hale, New Plymouth, and owned and tested by Mr. W. T. Williams, of Pukehou, Hawke's Bay. Holly Oak's Annie was granted a certificate for 1,056·49 lb. butterfat, making the third New Zealand Jersey to receive a C.O.R. on a butterfat-production exceeding 1,000 lb. Two Friesians also have this distinction.

During the year six class-leadership productions have been increased.

CERTIFICATES ISSUED.

Since the commencement of the C.O.R. system 4,832 cows have been granted first-class certificates. During 1925, certificates were issued on first performance for 658 cows, and on second or subsequent performance for 148 cows, making a total of 806 certificates issued during the year. Details are given in the following table, figures for the preceding year having been added for purposes of comparison :—

Breed.	1925.			1924.		
	Ordinary.	Repeat.	Total.	Ordinary.	Repeat.	Total.
Jersey	501	98	599	583	91	674
Friesian	107	40	147	148	43	191
Milking Shorthorn ..	24	6	30	32	6	38
Ayrshire	20	3	23	23	1	24
Red Poll	6	1	7	6	..	6
Totals ..	658	148	806	792	141	933

Second-class Certificates.—During 1925, second-class certificates were issued for twenty-two Jerseys, twelve Friesians, and two Milking Shorthorns. Obviously, therefore, the number of second-class certificates is a negligible proportion of the total certificates issued during the year. Grouping the cows of each particular breed into one class, the twenty-two second-class Jersey records averaged 471·29 lb. butterfat, and the twelve Friesians 519·37 lb. Of the two second-class certificates for Milking Shorthorns, one was for Matangi Quality 4th (now dead), whose butterfat-yield reached the high figure of 978·47 lb.

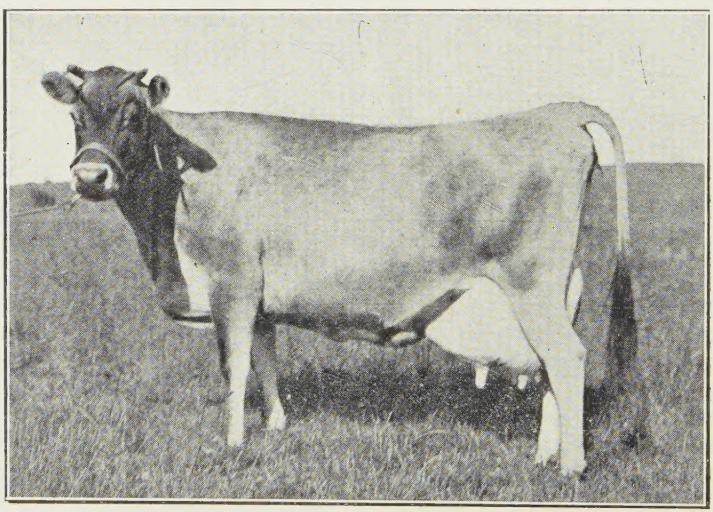
JERSEYS.

Class-leaders.

The list of Jersey class-leaders shows two changes for the year under review. The junior two-year-old Keston Flower, owned and tested by Mr. G. E. Yelchich, displaces Mr. F. J. Saxby's Alfalfa Pansy. The new leader, with a C.O.R. for 694·28 lb. butterfat, adds some 4 lb. to the performance of the previous holder of the position. The other change, which falls in the mature class, is notable on account of the fact that the previous record, made by Mr. A. Christie's Vivandiere, was no less than 1,036·09 lb. butterfat. Vivandiere yields her place to Mr. W. T. Williams's Holly Oak's Annie, with 1,056·49 lb., which is the highest C.O.R. Jersey record to date for New Zealand.

The class-leaders at the end of 1925 are as follows :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Keston Flower ..	G. E. Yelchich, Waiuku	1 359	240·5	365	11,472·2	694·28
Senior Two-year-old.						
Marshland's Stylish Princess	W. J. Chynoweth, Hamilton	2 353	275·8	365	9,927·7	715·75
Three-year-old.						
Loo's Queen ..	A. Christie, Tanekaha	3 332	310·2	365	13,422·3	797·32
Four-year-old.						
St. Lambert's Bell ..	A. J. Smith, Cardiff ..	4 283	341·8	365	14,423·1	780·32
Mature.						
Holly Oak's Annie ..	W. T. Williams, Pukehou	5 9	350·0	365	18,522·7	1,056·49



HOLLY OAK'S ANNIE.

Leader of Jersey mature class, and New Zealand champion of the breed.

Jersey Class-averages.

Of the five classes into which the Jersey breed is subdivided, only two, the mature and the four-year-old, show an increase over the preceding year. A total of 599 cows is represented, as against 674 for the previous year. It will be noticed that the majority of the cows fall into the junior two-year-old class; the mature class also containing a large proportion of the total.

The class-averages for 1925 and 1924 are given in the following table:—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1925.		lb.	lb.
Junior two-year-old ..	237	344	7,132·1	395·71
Senior two-year-old ..	59	347	8,154·6	457·64
Three-year-old	79	346	8,634·7	480·85
Four-year old	47	352	9,484·4	523·82
Mature	177	345	9,501·6	516·94
	1924.			
Junior two-year-old ..	253	350	7,417·0	409·80
Senior two-year-old ..	75	353	8,204·1	459·59
Three-year-old	90	348	9,026·9	498·42
Four-year-old	57	348	9,093·0	506·88
Mature	199	347	9,647·7	521·52

The following table shows the averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. testing system in 1912:—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Junior two-year-old ..	1,384	345	6,889·8	383·94
Senior two-year-old ..	393	344	7,617·8	427·49
Three-year-old	575	342	8,246·4	458·23
Four-year-old	355	344	8,704·1	482·99
Mature	955	345	9,223·5	503·49
All	3,662	344	7,965·4	441·06

Jersey C.O.R. Bulls.

Up to the end of 1925 some 213 Jersey bulls have qualified for the C.O.R. bull list; thirty-two names were added during the year under review, and ninety-eight are eligible for inclusion in this summary. The bulls marked † are champion butterfat bulls: that is to say, they qualify for the New Zealand Jersey Cattle Breeders' Association's special class for bulls with five or more C.O.R. daughters, each

daughter at least doubling its butterfat requirement for certificate, and each from a different dam. There are now nine champion butterfat bulls, and it will be noted that seven are eligible for inclusion in the following list :—

Key to numbers opposite names: First number—first-class C.O.R. daughters; second—ditto, qualified on subsequent performances; third—second-class C.O.R. daughters; fourth—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1925.

Grannie's Knight†	45	8	3	56	Achievement of Willow Bank	6	1	1	8
Sultan's Disdain	42	11	5	58	Perfection's King	6	2	0	8
Majesty's Fox	32	6	0	38	Avoca's Protection	6	1	0	7
Noble Twylish	29	4	0	33	Bright Knight	6	0	1	7
Fancy's Lord Twylish	21	9	0	30	Waipiko Leonard*	6	0	0	6
Roberts	21	0	0	21	Brampton Merry Boy*	6	0	0	6
Viola's Golden Laddie	20	6	1	27	Beachlands Admiral	6	0	0	6
Te Rapa Lad	19	1	0	20	Majesty's Squire	6	0	0	6
Proud Fox	17	6	1	24	Miro Meadows Quickshine	6	0	0	6
Neathead's Majesty	17	5	2	24	Rita's Molina	6	0	0	6
Mona's Ally	17	1	0	18	Golden Swan's Lad	6	0	0	6
V.C.†	16	2	0	18	Hawkesbury Majestic	6	0	0	6
Belvedere Bilberry's Last	15	1	0	16	Juno's Laddie	6	0	0	6
The General	14	6	1	21	Una's Nobility	6	0	0	6
Sunflower's Perseus†	14	4	0	18	Woodstock's Lord Raleigh	6	0	0	6
Lady's Duke	14	1	1	16	Fox's Double*	6	0	0	6
Sweet Fox of Collingwood	14	1	0	15	Defender of Meadowvale	5	2	0	7
Meadowvale Conqueror	13	2	0	15	Nestor of Willowbank	5	2	0	7
Rose's Attraction's Fox†	13	0	1	14	Rimu	5	2	0	7
Hawkesbury Emperor	12	4	0	16	K. See 7th*	5	0	2	7
Petune's Noble	12	1	3	16	Prince Enid	5	1	1	7
Molina's General	12	3	0	15	Belvedere Bilberry's Bob	5	1	0	6
Bilberry's Twylish†	12	1	2	15	Miro Meadows Dick	5	1	0	6
Soumise Majesty	12	1	0	13	Woodstock's Golden Lad*	5	0	1	6
Miro Meadows Star	12	0	0	12	Darkie's Pride*	5	0	0	5
Rainbow's King	11	2	1	14	Miro Meadows Glaxo*	5	0	0	5
Twylish Hope	11	2	0	13	Belvedere Silver Trumpeter*	5	0	0	5
Pecuarius	11	0	0	11	Aster's Golden Lad*	5	0	0	5
Bridge View's Magnet	11	0	0	11	Dainty's Enigma's K.C.*	5	0	0	5
Maid's General	10	1	1	12	Rewarder*	5	0	0	5
Noble Sultan	10	1	0	11	Ravenswood Model*	5	0	0	5
Waipiko Masterpiece†	9	2	0	11	Lord Maitland	5	0	0	5
Eileen's Fox	9	2	0	11	Molly's Lad	5	0	0	5
Maori Captain	9	1	0	10	Majestic Duke	5	0	0	5
Maid's Noble General	9	1	0	10	Miro Meadows Hope*	5	0	0	5
Owler of Puketapu†	9	0	1	10	Flora's Good Cheer*	4	1	0	5
Genoa Nelson Chase	8	2	0	10	Laurel's Orange Lad*	4	1	0	5
Soumise Prince*	8	1	0	9	Grafton Pepper's Boy	4	0	0	4
Butterman Lad	8	1	0	9	Anzac*	4	0	0	4
Golden Fox	8	0	1	9	Matokitoki's Lad*	4	0	0	4
Waipiko Josiah	8	0	0	8	Brentwood Hero*	4	0	0	4
Exile of Cloverland*	7	0	1	8	Bluebeard of Puketapu*	4	0	0	4
Meadowvale General Daisy*	7	0	1	8	Caius*	4	0	0	4
Distinction's Twylish*	7	0	1	8	Eaton Lord Charm*	4	0	0	4
Grannie's Campanile Sultan	7	1	0	8	Queen's Glory Lad*	4	0	0	4
Reid Park's Lord	7	0	0	7	Bright Sultan*	4	0	0	4
Signor	7	0	0	7	Capsicum's Maple*	4	0	0	4
Floss's Starlight	6	2	1	9	Molina's Primrose*	4	0	0	4
Brentwood's Fancy's Swan*	6	0	2	8	Rozel's Boy*	4	0	0	4

FRIESIANS.

Class-leaders.

The Friesian class-leaders remain as at the end of 1924. Despite this fact, however, some noteworthy performances have been authenticated during the year, and four cows have been granted certificates on yields exceeding 900 lb. butterfat. The highest of these four certificates is one for 950·90 lb., made by Mr. T. H. Richards's Monavale Queen Bess in the mature class. It may be recalled that this cow already has two certificates to her credit, on each of which she remains a class-leader. As shown in the table, these certificates were gained in the junior two-year-old and junior three-year-old class respectively.

The list is here reprinted :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys	lb.		lb.	lb.
Junior Two-year-old.						
Monavale Queen Bess	T. H. Richards, Cardiff	2 16	242·1	365	20,501·1	740·50
Senior Two-year-old.						
Netherland Princess 4th	John Donald, Westmere	2 341	274·6	365	19,621·6	805·77
Junior Three-year-old.						
Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
Senior Three-year-old.						
Manor Beets Daughter 2nd of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·9	863·51
Junior Four-year-old.						
Westmere Princess Pietertje	John Donald, Westmere	4 156	329·1	365	24,199·0	939·78
Senior Four-year-old.						
Bainfield 27th ..	C. H. Potter, Pukerau	4 351	348·6	365	23,203·3	910·74
Mature.						
Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·5	1,145·24

Friesian Class-averages.

Four classes out of the seven into which the Friesian breed is subdivided show increases for 1925 as compared with 1924. The classes which improved their average production were the junior two-year-olds, the junior and senior four-year-olds, and the mature. As the 1924 averages were, on the whole, of a fairly high standard, this increase must be considered very satisfactory. In total numbers, however, there has been a decrease, 147 certificates having been awarded during the year as compared with 191 for the preceding twelvemonth.

The figures for 1925 and 1924 are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1925.		lb.	lb.
Junior two-year-old ..	44	349	12,094·8	428·09
Senior two-year-old ..	13	357	12,565·3	442·42
Junior three-year-old ..	13	319	12,048·5	436·60
Senior three-year-old ..	11	328	13,358·8	492·47
Junior four-year-old ..	5	336	15,458·6	548·46
Senior four-year-old ..	8	352	16,301·8	581·85
Mature	53	332	16,559·3	573·82
	1924.			
Junior two-year-old ..	51	355	11,516·8	400·04
Senior two-year-old ..	31	352	13,286·0	472·86
Junior three-year-old ..	24	336	13,637·3	471·33
Senior three-year-old ..	11	342	14,502·7	499·93
Junior four-year-old ..	11	347	15,293·2	541·69
Senior four-year-old ..	7	332	15,462·1	501·42
Mature	56	340	16,516·5	562·54

The following table shows the averages, class by class, of all certificates issued for Friesian cows since the commencement of the C.O.R. testing in 1912 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Junior two-year-old ..	373	347	11,203·9	398·06
Senior two-year-old ..	179	346	12,125·4	429·61
Junior three-year-old ..	137	340	13,087·0	459·83
Senior three-year-old ..	135	339	13,611·2	482·80
Junior four-year-old ..	85	342	14,392·3	508·00
Senior four-year-old ..	82	347	15,590·1	541·09
Mature	388	339	15,367·1	537·10
All	1,379	343	13,375·0	470·99

Friesian C.O.R. Bulls.

The Friesian C.O.R. bulls have now reached a total of eighty-two, seven new names having been added during the year. Of the seventy-five bulls which had qualified to the end of the preceding year (1924) twelve have increased the number of their C.O.R. daughters, thus making nineteen names eligible for inclusion in the present summary.

The list is as follows :—

Key to numbers opposite names: First number—first-class C.O.R. daughters; second—ditto, qualified on subsequent performances; third—second-class C.O.R. daughters; fourth—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1925

King Segis Wild Rose Homestead ..	22	7	0	29
Cliffside Laddie ..	21	5	0	26
Dominion Woodcrest Piebe Mercedes ..	13	2	0	15
Bainfield Dutchman ..	12	4	2	18
Rosevale Korndyke Sylvia Posch ..	11	9	1	21
Rosevale King Sylvia..	11	3	3	17
Marquis Segis Colantha	9	2	1	12
Mutual Mercedes Pietertje	9	1	0	10
Black and White King of Ashlynn ..	7	0	1	8
King Pontiac Korndyke*	6	1	0	7
Woodcrest Johanna Pontiac	6	1	0	7
Dominion Woodcrest Beets*	6	0	0	6
Marquis Piebe de Kol	6	0	0	6
King Segis of Friesland Park	5	1	1	7
Dominion Paul Colantha*	5	0	0	5
Pietje Johanna de Kol*	5	0	0	5
Woodcrest Pontiac Alcartra*	4	1	1	6
Brookland's Waihi Segis*	4	1	0	5
Rosevale Plus Triumph*	4	1	0	5

ALCARTRA CLOTHILDE PIETJE.

Leader of Friesian mature class, and New Zealand champion of the breed.

MILKING SHORTHORNS.

Class-leaders.

With the exception of the senior two-year-old class, the class-leaders for the Milking Shorthorn breed remain as at the end of 1924. In the senior two-year-olds Mr. G. N. Bell's Birkland Dainty, with 459·98 lb. butterfat, yields her place to Mereside Gem, owned by Mr. W. Bowis, Doyleston. The new leader is credited with 461·52 lb. fat, thus increasing the record for this class by less than 2 lb. of butterfat.

The Milking Shorthorn class-leadership list is now as follows:

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old.						
Mereside Gem ..	W. Bowis, Doyleston	2 350	275·5	365	11,286·3	461·52
Junior Three-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old.						
Matangi Nancy 2nd	Ranstead Bros., Matangi	4 3	313·8	365	15,591·6	608·28
Senior Four-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	4 355	349·0	340	11,670·3	644·90
Mature.						
Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

Milking Shorthorn Class-averages.

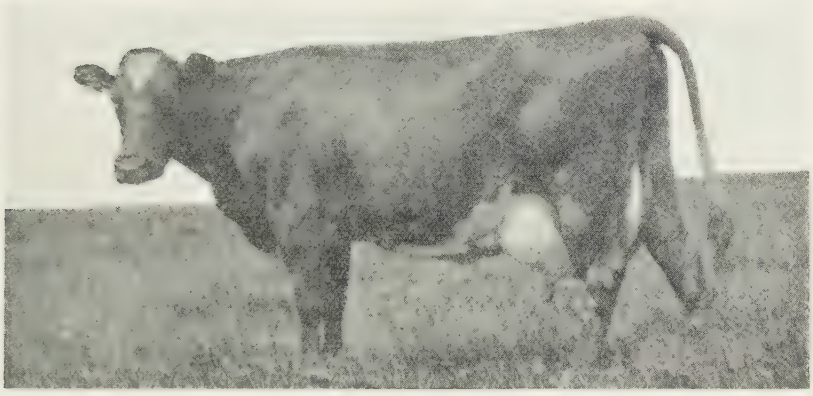
The number of certificates issued to cows of this breed in 1925 shows a decrease of eight over the previous year. This must be accepted as considerable when it is borne in mind that only thirty certificates were issued during the year under review and thirty-eight in 1924. Seeing that the classes are small, three having only one representative each, a comparison is really of little value. We therefore leave the figures to speak for themselves.

The class-averages for 1925, together with those for the preceding year, are as follows:—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1925.		lb.	lb.
Junior two-year-old ..	7	345	8,943·7	367·18
Senior two-year-old ..	1	365	11,286·3	461·52
Junior three-year-old ..	1	305	11,790·5	498·93
Senior three-year-old ..	2	330	10,344·5	463·93
Junior four-year-old ..	3	345	9,598·5	423·88
Senior four-year-old ..	1	360	12,081·1	498·11
Mature	15	335	13,380·3	541·55
	1924.			
Junior two-year-old ..	6	344	8,372·0	337·77
Senior two-year-old ..	3	350	7,478·8	302·35
Junior three-year-old ..	3	354	12,722·7	523·81
Senior three-year-old ..	4	352	12,133·4	508·36
Junior four-year-old ..	2	365	11,179·3	435·16
Senior four-year-old ..	4	349	12,846·1	574·19
Mature	16	341	13,310·1	536·50

The following table shows the averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Junior two-year-old ..	37	352	8,560·4	345·61
Senior two-year-old ..	22	345	8,309·2	332·07
Junior three-year-old ..	18	335	9,628·4	382·36
Senior three-year-old ..	16	343	10,645·2	449·35
Junior four-year-old ..	15	348	10,524·9	423·57
Senior four-year-old ..	16	346	11,744·8	470·87
Mature	207	341	11,468·6	457·45
All	331	343	10,764·3	431·25



GLENTHORPE LADY.

Leader of Milking Shorthorn mature class, and New Zealand champion of the breed.

Milking Shorthorn C.O.R. Bulls.

The C.O.R. bulls of the Milking Shorthorn breed now total five, the name of Matangi Pride having been added during the year under review. Matangi Pride has seven C.O.R. daughters to his credit, all first-class certificates gained in 1925. Only one of the bulls previously qualified failed to add to his list of C.O.R. daughters since our last annual review. Details of those bulls eligible for mention in this summary are as follows :—

Key to numbers opposite names: First number—First-class C.O.R. daughters; second—ditto, qualified on subsequent performances; third—second-class C.O.R. daughters; fourth—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1925.

Dominion Esau of Ruakura	14	2	2	18	Matangi Pride ..	7	0	0	7
Dilworth Baronet ..	6	1	1	8	Marlborough of Darbalara	5	0	0	5

AYRSHIRES.

Class-leaders.

The year under review brought two changes to the class-leadership figures of the Ayrshire breed. In the two-year-old class Mr. W. Hall's Dimple of Edendale, with 529·46 lb. butterfat, gives way to Fair Maid of Greenbank, owned and tested by Mr. W. Moore, Homebush. The new leader has increased the maximum yield for a cow of this class by no less than 144 lb. fat. The other change occurs in the mature class. The previous leader, Ivanhoe Fillpail, owned and tested by Mr. A. M. Weir, Menzies Ferry, held the leadership on a C.O.R. for 646·31 lb. fat. Glencairn Brownie goes to the head of this class with 728·05 lb. fat, an increase of some 82 lb. Glencairn Brownie, who is now the New Zealand champion for the Ayrshire breed, was owned and tested by Mr. A. Montgomerie, of Kauwhata.

The present Ayrshire class-leaders are as follows:—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Fair Maid of Greenbank	W. Moore, Homebush	2 27	243·2	365	12,281·3	673·56
Three-year-old.						
Ivanhoe Stylish Daisy	A. M. Weir, Menzies Ferry	3 312	308·2	365	12,334·2	574·09
Four-year-old.						
Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature.						
Glencairn Brownie ..	A. Montgomerie, Kauwhata	8 360	350·0	365	15,579·4	728·05

Ayrshire Class-averages.

Twenty-three certificates were issued to Ayrshires in 1925, the same number as in 1924. Many good Ayrshire yields were recorded during the year, and as a result the class-averages in three classes out of the four have considerably increased. They now stand for the two years as follows:—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1925.		lb.	lb.
Two-year-old	5	365	12,298·0	512·54
Three-year-old	2	341	9,162·6	354·84
Four-year-old	3	345	14,043·4	549·24
Mature	13	348	12,743·0	529·69
	1924.			
Two-year-old	6	354	7,025·0	297·01
Three-year-old	3	363	11,932·4	519·03
Four-year-old	3	355	11,603·6	471·87
Mature	12	353	11,442·2	466·93

The following table shows the averages, class by class, of all certificates issued to Ayrshire cows since the commencement of the C.O.R. testing in 1912 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Two-year-old	40	343	8,943·5	364·44
Three-year-old	26	348	9,887·1	401·97
Four-year-old	19	348	11,309·2	464·02
Mature	75	347	11,633·0	482·03
All	160	346	10,638·4	437·48

IVANHOE FANCY.
Leader of Ayrshire four-year-old class.

Ayrshire C.O.R. Bulls.

The number of Ayrshire bulls which have qualified for the C.O.R. list remains as at the close of 1925, the total being six. Of these only one, Hindsward Jimmie of Townhead, added to his previous total, his number of C.O.R. daughters having been increased by five. The figures for this bull now stand at eleven daughters with first-class certificates, and one of these with a certificate on a second performance.

RED POLLS.

Class-leaders.

One change of class-leadership has to be recorded for the Red Poll breed. Dominion Sylphide, with 430·74 lb. butterfat, owned and tested by the Central Development Farm, Weraroa, is replaced by Wayward 6th B No. 1—511·42 lb. butterfat—owned and tested by Mr. G. S. Young, West Plains, Southland. The previous leader commenced her test at the age of 1 year 339 days, and the commencing age of the new leader was 2 years 188 days.

The highest yields for each class are shown in the following table :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Wayward 6th B No 1	G. S. Young, West Plains	2 188	259·3	365	11,228·0	511·42
Three-year-old.						
Dominion Gold Top..	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old.						
Dominion Opticia ..	Central Development Farm, Weraroa	4 343	347·8	365	9,958·50	441·27
Mature.						
Dominion Sylph ..	Central Development Farm, Weraroa	5 4	350·0	365	11,009·00	505·84

WAYWARD 6TH B NO. 1.

Leader of Red Poll two-year-old class, and New Zealand champion of the breed.

Red Poll Class-averages.

Seven Red Polls gained certificates of record in 1925, five of these being owned and tested by the Central Development Farm, Weraroa,

and the remaining two by Mr. G. S. Young, West Plains, Southland. Six of the Red Polls certificated last year were in the junior two-year-old class, and the seventh commenced test as a senior three-year-old.

The following table shows the position for 1925 :—

Class.	Number of Cows.	Days in Milk.	Milk.	Fat.
			lb.	lb.
Two-year-old	6	346	7,938·9	365·97
Mature	1	333	9,185·6	410·39

The following table shows the averages, class by class, of all certificates issued to Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Two-year-old	22	342	7,599·6	345·53
Three-year-old	11	343	8,066·4	351·85
Four-year-old	4	336	8,763·9	381·66
Mature	10	332	9,919·5	436·23
All	47	340	8,301·5	369·38

Red Poll C.O.R. Bulls.

In the present summary Red Poll C.O.R. bulls appear for the first time. Owing to the small number of Red Poll cows entered for C.O.R. test, this list was previously not prepared. It is now found that three bulls are eligible for inclusion—namely, Force Majeure, 13—1—0—14; Belligerent, 6—2—0—8; and Aviator, 5—0—0—5. The twenty-four C.O.R. daughters included under these three names were all owned and tested by the Central Development Farm, Weraroa.

EXPORT OF PUREBRED DAIRY CATTLE.

The calendar year 1925 showed a falling-off in the number and total value of purebred dairy cattle exported from the Dominion. Some ninety-three animals were sent out of the country, forty-nine of these going to Australia, twenty-one to Argentine, nineteen to Fiji, three to South Africa, and one to Tonga. The total declared value of these beasts was about £5,200. The previous year's figures were 178 animals, valued at some £8,635.

We desire to thank once again the secretaries of those breeders' associations co-operating with the Dairy Division in connection with the C.O.R. testing system for the cordial assistance rendered during the year—namely, Messrs. W. M. Tapp (Jersey), J. P. Kalaugher (Friesian), W. Hunter (Milking Shorthorn), R. H. Spencer (Ayrshire), and N. Inder (Red Poll).

OAT-SMUT.

SURVEY AND EXPERIMENTAL WORK, SEASON 1925-26.

J. C. NEILL, Field Mycologist, Biological Laboratory, Wellington.

OAT-SMUT has this year destroyed 600,000 bushels of oats in Canterbury, Otago, and Southland—a direct loss of £135,000. This loss may be almost wholly prevented by simple treatment of the seed-grain at a cost of less than a penny per bushel. The evidence in support of these statements is here presented.

INCIDENCE OF THE DISEASE.

In January and February of this year the writer, in collaboration with Messrs. F. W. Greenwood, F. E. Ward, R. B. Tennent, and R. McGillivray, Instructors in Agriculture for Marlborough, Canterbury, and Otago and Southland respectively, made a flying survey of the cereal diseases present in the South Island. A few crops taken at random in each locality were carefully examined, and the percentage of disease present estimated on a series of plant counts.

The results obtained in regard to oat-smut are here given in tabular form. The loss due to smut is computed on an acreage basis. Thus a crop of 100 acres showing 10 per cent. of smut is listed as losing 10 acres, which, at 38·7 bushels per acre (the Dominion average yield for 1924–25), represents 387 bushels, valued at 4s. 6d. per bushel. In calculating the aggregate loss in yield only crops showing smut to the extent of 1 per cent. or over are here considered, though in the aggregate the loss in the many crops showing from a trace to 1 per cent. must be considerable. Nor is any account taken of the deterioration in the quality of the grain or chaff caused by the presence of the smut. It is assumed in calculating each aggregate provincial loss that the crops examined represented a fair sample of the whole.

OAT-SMUT.

The spore masses are held in place by the external glumes.

[*Photo by H. Drake.*

Table 1.—Number and Condition of Crops examined.

Province.	Examined.	Clean.	Smutted.		
			Trace to 1 per Cent.	1 per Cent. to 20 per Cent.	Above 20 per Cent.
Marlborough ..	12	10	2	..	..
Canterbury ..	35	18	12	5	..
Otago	100	12	41	33	14
Southland	110	11	47	42	10

Table 2.—Estimated Losses from Oat-smut.

Province.	Crops examined.			Statistical Estimate.		
	Area.	Actual Loss.		Provincial Area in Oats, 1925–26.	Loss.	
					Quantity.	Value.
	Acres.	Acres.	Bushels.	Acres.	Bushels.	£
Marlborough ..	398	..	..	15,000	..	..
Canterbury ..	1,175	13·8	534	187,000	84,915	19,100
Otago	5,119	528·0	20,434	82,000	326,938	73,600
Southland ..	2,362	157·0	6,076	71,000	182,277	41,000
Totals ..	9,054	698·8	27,044	355,000	594,130	133,700

PREVENTIVE TREATMENT.

Smut in oats is wholly due to sowing infected seed. In most parts of New Zealand it is safe to say that unless the seed is disinfected smut is certain to appear in the crop. At the present state of our knowledge the most satisfactory means of disinfection is by means of the formalin steep. This has been the experience of many farmers, and is confirmed by the experimental results given below. If correctly applied it apparently causes little or no damage to the seed-grain, and it has given more complete control of the smut than any of the other chemical methods tried.

A simple and effective method of applying the treatment is as follows: In a tin bath, wooden or concrete trough, or other receptacle mix the formalin with water in the proportion of 1 pint of formalin to 40 gallons of water. Do not guess, but measure the quantities accurately, for on their correctness largely depends the success of the treatment. Put half of each sack of seed oats into another sack, so that the sacks for treatment are not more than half full. Immerse the sacks and grain below the surface of the formalin solution for exactly ten minutes, moving the sack and grain about several times while under. At the end of ten minutes remove the sack from the solution. A good method for this is by means of a block and tackle rigged over the trough, by which the sack can be lifted and left for a while suspended over and draining back into the trough. The sack is then thrown on the ground and the grain flattened out to an even layer within the sack. If the operation is performed in the evening the grain will be fit for sowing the next morning. Do not empty the

grain into other sacks unless they have been previously disinfected; it is also a wise precaution before sowing to wash out the drill with formalin solution made up in the proportion of one part of formalin to ten parts of water. A pint bottle of formalin costs about 2s. 9d., and it will make enough solution to treat about 50 bushels of seed oats. Dipping may be continued in the same solution until the level is too low to cover the sacks, when fresh solution should be added in the same proportions—1 pint of formalin to 40 gallons of water.

GENERAL DISCUSSION.

The chief disadvantage of the formalin steep is that, while it reduces to small proportions the smut present in the crop even when grown from heavily infected seed, it does not eliminate the smut altogether. For this reason the seed must be treated every year, and probably there are enough careless farmers in any district who, by failing to treat, ensure that losses from smut shall continue. There are certain isolated oat-growing areas in New Zealand where, though the growers do not treat, no smut develops except in an occasional crop grown from imported seed. This freedom from the disease is not by reason of soil or climatic condition, but solely because the smut fungus is not present in the area. If a method of seed-disinfection can be evolved that will completely disinfect there is no reason why, by co-operative effort, the other oat-growing districts may not also get rid of both the disease and of the yearly necessity to steep.

It is with this idea in mind that the experiments detailed below have this season been carried out. It will be seen on examination of the tabulated results that the hot-water method is the only one which completely disinfected the seed. Unfortunately, certain at present inexplicable features of these results make further experiments with this method necessary before it can be practically applied.

SUMMARY OF EXPERIMENTAL RESULTS (SEE TABLE 3).

(1.) The mercuro-phenol treatments—Uspulun, Germisan, Semesan, Corona 640 steeps, and Semesan dust — all failed to more than partially control oat-smut, but all produced more plants and heads per seed sown than the untreated controls. This applies also to Clarke's Wheat Protector.

(2.) Copper-carbonate dusts reduced infection to about 5 per cent., as against from 25 per cent. to 40 per cent. in the controls. It also produced more plants and heads per seed sown. Colloidal copper-dust acted similarly, though not so effectively as the copper carbonate.

(3.) Copper sulphate (bluestone) reduced the germinative energy, and, on the average, produced fewer plants and heads per seed sown. It reduced the smut to about 4 per cent.

(4.) Formalin, 1–320 (= 1 pint to 40 gallons), while it reduced the smut to from 0·3 per cent. to 4 per cent., as against from 20 per cent. to 50 per cent. in the adjacent controls, showed little or no damage to the seed. At the strength of 1–480 (= 1 pint to 60 gallons) there was an improvement over controls in plants and heads produced, but the smut rose to from 4 per cent. to 9 per cent. The presoak

Table 3.—Experiments on Oat-smuts at Ashburton Experimental Farm, Season 1925-26.

Treatment.	Dun.										Garton (Invercargill).										Garton (Kelso).									
	Percentage Germination.				Plants.				Heads.			Percentage Germination.			Plants.			Heads.			Percentage Germination.			Plants.			Heads.		
	In Laboratory.	In Field.			Smutted.							In Laboratory.	In Field.		Smutted.						In Laboratory.	In Field.			Smutted.					
		First Count.			Total.	Ustilago levis.	Ustilago Avenae.	Percentage smutted.	Total.	Smutted.	Percentage smutted.		First Count.			Total.	Ustilago levis.	Ustilago Avenae.	Percentage smutted.	Total.	Smutted.	Percentage smutted.		First Count.			Total.	Ustilago levis.	Ustilago Avenae.	Percentage smutted.	Total.	Smutted.	Percentage smutted.
		%	PE ±	Mature Plants.									%	PE ±	Mature Plants.																
Control ..	85·5	67·0	2·2	61·0	122	15	10 20·5	427	83	19·5	97·2	71·5	1·99	69·5	139	59	1	13·2	323	122	17·9	98·0	75·0	2·04	61·0	122	36	12	30·4	255	105	36·9
Copper carbonate No. 1	97·5	81·7	1·36	78·5	314	27	6 10·5	933	88	9·4	97·0	81·7	1·47	79·5	318	14	2	3·1	791	39	1·9	96·5	70·7	1·19	64·7	259	6	8	3·1	517	27	5·9
Control ..	85·5	65·5	1·96	62·5	125	32	7 31·2	461	127	27·5	97·2	83·5	1·84	80·0	160	71	2	45·0	388	155	10·0	98·0	63·5	1·82	50·5	101	41	15	18·5	211	97	46·9
Copper carbonate No. 2	97·5	78·7	1·03	77·5	310	15	4 6·1	1,108	53	4·7	96·5	77·0	1·75	74·7	299	18	2	5·7	713	33	4·4	96·5	61·3	2·14	51·0	216	8	3	3·1	384	19	5·0
Control ..	85·5	60·0	1·72	67·0	134	30	8 28·3	484	125	25·9	97·2	73·0	1·75	63·5	129	99	1	54·1	321	141	13·8	98·0	66·0	1·65	55·5	111	40	6	11·5	213	86	40·9
Colloidal copper ..	97·5	75·0	1·53	75·5	302	15	13 9·2	985	82	8·3	97·0	76·3	2·10	73·2	293	26	1	9·2	750	54	7·2	97·5	61·5	2·13	57·2	229	16	8	10·5	145	10	9·0
Control ..	85·5	68·0	1·84	66·0	132	28	7 26·5	493	101	20·5	97·2	78·0	2·11	69·0	138	65	3	19·3	342	119	13·5	98·0	63·5	1·80	48·0	96	19	1	5·3	157	117	62·5
Semesan dust ..	93·0	77·0	1·33	74·2	297	37	22 19·8	963	157	16·3	98·0	81·7	1·81	76·2	305	92	2	30·8	793	192	24·3	96·5	68·0	1·79	55·5	222	63	27	30·6	138	161	37·5
Control ..	85·5	65·5	1·74	59·0	118	18	10 23·7	440	79	18·0	97·2	75·5	2·08	64·0	128	72	0	56·2	308	151	49·0	98·0	65·5	1·41	52·5	105	41	12	30·6	197	91	46·0
Semesan steep ..	93·0	77·5	1·48	73·5	294	31	11 14·3	1,047	110	10·5	98·0	81·0	1·48	78·2	313	80	2	26·0	802	179	22·2	99·0	71·3	1·47	54·2	217	58	10	31·4	439	117	21·6
Control ..	85·5	59·5	1·92	66·5	133	37	11 36·2	460	136	29·5	97·2	75·5	1·72	67·0	134	76	5	66·4	330	176	53·3	98·0	63·0	1·56	51·5	103	31	6	36·0	202	63	31·2
Corona 640 steep ..	90·0	76·3	1·74	72·0	288	66	39 36·4	1,057	311	31·4	97·0	84·7	1·16	81·0	324	86	5	28·1	751	176	23·4	98·5	69·7	1·63	48·7	195	84	22	54·2	372	182	49·0
Control ..	85·5	69·5	1·55	64·0	128	35	7 32·8	420	116	27·6	97·2	69·5	1·88	61·0	122	65	2	55·0	292	143	18·8	98·0	64·5	1·65	51·5	103	35	8	41·8	198	79	40·3
Uspulun	86·0	81·0	1·50	77·7	311	25	14 12·5	1,098	107	9·7	97·5	82·7	2·09	78·0	312	68	0	21·8	763	129	16·8	96·0	71·3	1·85	62·7	251	59	21	31·9	523	155	29·5
Control ..	85·5	67·5	1·48	66·0	132	34	9 32·6	447	123	27·5	97·2	71·5	1·67	64·0	128	68	2	54·8	315	152	18·2	98·0	72·0	1·20	53·5	107	35	7	39·3	228	77	33·7
Germisan	84·5	79·3	1·38	82·5	330	16	10 7·9	1,083	78	7·2	98·5	80·5	1·33	77·7	311	21	0	6·8	765	11	5·3	96·5	75·0	1·51	60·7	279	16	1	7·2	517	35	6·4
Control ..	85·5	67·5	1·42	68·5	137	33	5 27·7	443	95	21·5	97·2	82·5	1·51	73·5	147	84	1	57·8	361	181	49·7	98·0	67·5	1·81	56·5	113	19	5	17·8	205	89	43·4
Clarke's Wheat Protector	90·0	71·0	1·62	69·7	279	25	4 10·4	908	74	8·1	95·5	81·3	2·01	77·5	310	62	2	20·6	754	122	16·2	97·0	65·5	1·52	52·5	210	32	10	20·0	373	78	20·5
Control ..	85·5	69·5	1·52	68·5	137	21	5 19·0	437	67	15·4	97·2	75·5	1·31	71·0	142	67	2	18·6	362	151	11·8	98·0	59·0	1·91	45·0	90	25	7	35·6	167	51	30·9
Bluestone 1% ..	..	..	..	..	..	..	.. ..	..	..	..	..	..	..	94·0	75·0	1·86	71·5	286	13	1	4·9	66·6	24	3·6	99·0	59·7	1·98	50·0	200	13	1	8·5	374	26	7·9
Control ..	..	..	..	..	..	..	.. ..	..	..	..	..	..	..	97·2	77·5	1·41	72·5	145	64	2	18·5	361	137	37·9	98·0	60·5	1·98	45·0	90	21	16	41·2	158	66	39·9
Bluestone 2% ..	75·5	53·5	1·67	61·5	246	6	2 3·2	705	31	4·4	92·0	63·5	1·59	61·7	247	17	0	6·9	548	25	1·6	83·5	54·7	1·70	51·5	200	8	0	3·9	361	13	3·6
Formalin 1–320 ..	87·5	69·3	1·79	67·7	271	9	0 3·3	778	23	3·0	94·0	71·0	0·88	64·0	256	1	0	0·4	666	2	0·3	97·5	56·5	2·18	48·2	193	7	1	1·1	379	16	4·2
Control ..	85·5	67·5	..	64·5	129	23	6 22·4	325	64	19·7	97·2	65·0	1·66	62·5	125	73	0	58·4	282	159	56·4	98·0	63·5	1·70	45·0	90	29	14	17·7	169	78	46·1
Formalin 1–480 ..	..	..	..	..	..	..	.. ..	..	..	..	..	..	..	97·5	78·5	1·26	72·2	289	16	1	5·9	743	28	3·8	94·5	61·5	1·53	52·2	209	22	2	11·5	414	39	9·4
Control ..	..	..	..	..	..	..	.. ..	..	..	..	..	..	..	97·2	72·7	1·64	66·0	132	65	4	52·3	338	151	14·7	98·0	61·5	1·92	50·5	101	37	9	45·6	214	94	44·0
Formalin 1–320 presoak ..	..	..	..	..	..	..	.. ..	..	..	..	..	..	..	95·0	78·5	2·00	75·0	300	4	1	1·7	737	7	1·0	69·0	70·3	1·52	63·5	254	21	0	8·3	597	37	6·2
Control ..	..	..	..	..	..	..	.. ..	..	..	..	..	..	..	97·2	68·5	2·62	64·7	259	108	2	42·5	626	234	37·5	98·0	68·0	..	60·0	120	44	17	50·8	282	137	18·5

NOTE.—The PE of each control is computed in combination with the next succeeding control. (This does not apply to the hot-water series on next page.)

Table 3.—Experiments on Oat-smuts—continued.

Treatment.	Dun.											Garton (Invercargill).										
	Percentage Germination.			Plants.				Heads.			Percentage Germination.			Plants.				Heads.			
	In Laboratory.	In Field.			Smutted.						In Laboratory.	In Field.			Smutted.						
		First Count.		Mature Plants.	Total.	*Ustilago levis.*	*Ustilago Avenæ.*	Percentage smutted.	Total.	Smutted.	Percentage smutted.		First Count.		Mature Plants.	Total.	*Ustilago levis.*	*Ustilago Avenæ.*	Percentage smutted.	Total.	Smutted.	Percentage smutted.
		%	PE										%	PE								
Hot water—																						
4 hrs. @ 104	..	..	..	..	..	..	..	..	..	..	..	97·5	74·0	2·18	60·2	265	104	0	39·1	680	218	32·2
6 hrs. @ 104	..	..	..	..	..	..	..	..	..	..	..	97·0	70·5	2·24	61·2	257	90	1	35·5	720	228	31·8
8 hrs. @ 104	..	..	..	..	..	..	..	..	..	..	..	98·0	79·0	1·32	71·2	297	106	0	35·7	808	255	30·1
10 hrs. @ 104	..	..	..	..	..	..	..	..	..	..	..	98·0	74·0	1·90	71·7	287	66	0	23·0	798	148	18·5
12 hrs. @ 104°	..	..	..	..	..	..	..	..	..	..	..	94·0	72·0	1·58	70·2	281	34	0	12·1	813	73	9·0
Control	85·5	70·3	1·88	71·5	286	60	12	24·8	1,384	325	23·6	97·2	71·3	1·95	70·7	283	38	5	36·4	814	241	29·6
10 min. @ 121°	98·5	77·7	1·37	76·7	307	3	0	1·0	1,469	7	0·5	99·0	67·0	2·18	67·2	269	6	0	2·2	867	15	1·9
10 min. @ 125°	97·5	78·0	1·53	75·7	303	7	0	2·3	1,382	20	1·4	97·0	67·5	2·04	68·5	274	1	0	0·3	849	3	0·3
10 min. @ 127°	97·5	75·3	1·72	72·2	289	0	1	0·3	1,187	2	0·2	97·0	77·3	1·72	75·2	301	0	0	0	865	0	0
10 min. @ 129	93·0	72·3	1·34	68·7	275	0	0	0	1,211	0	0	96·5	70·7	2·30	69·5	278	0	0	0	850	0	0
10 min. @ 131°	96·0	71·0	1·56	71·7	287	1	0	0·3	1,290	2	0·1	98·0	68·7	1·80	69·5	278	0	0	0	886	0	0
10 min. @ 133	96·5	77·0	1·24	75·0	300	0	0	0	1,373	0	0	98·5	62·7	2·02	62·5	250	0	0	0	842	0	0
10 min. @ 137°	91·0	79·0	1·36	78·2	313	3	0	1·0	1,429	8	0·5	96·5	63·7	3·04	*59·3	178	3	0	1·7	555	6	1·1
Control	..	..	..	..	..	..	..	..	..	..	..	97·2	67·7	2·71	*61·0	102	68	2	36·4	606	179	29·8
6 hrs. @ 60° + 10 min. @ 121°	95·0	81·5	1·05	81·2	325	8	0	2·5	1,430	32	2·2	98·0	68·7	1·80	68·0	272	6	0	2·2	835	14	1·7
,, @ 125°	95·0	74·7	2·10	74·2	297	5	0	1·7	1,361	8	0·6	99·0	72·3	2·06	69·0	276	8	0	2·9	851	10	1·9
,, @ 127	100·0	70·7	1·99	70·0	280	9	0	3·2	1,193	22	1·8	97·5	72·7	1·51	72·0	288	7	0	2·4	822	11	1·3
,, @ 129	96·5	74·7	1·58	72·2	289	6	0	2·1	1,309	12	0·9	98·0	72·5	2·20	69·2	277	20	0	7·2	803	45	5·6
,, @ 131°	93·0	79·0	2·02	79·5	318	4	0	1·3	1,408	14	1·0	98·5	65·3	2·04	63·5	254	11	0	4·3	783	25	3·2
,, @ 133°	80·5	61·5	1·98	62·5	250	11	0	4·4	1,121	27	2·4	93·0	66·3	1·82	64·0	256	10	0	7·4	709	50	7·1
,, @ 137	70·5	41·3	1·85	45·5	182	2	0	1·1	557	7	1·3	87·0	38·5	2·11	37·2	149	13	0	8·7	385	29	7·5
Control	85·5	69·5	2·02	66·0	264	54	11	24·6	761	169	22·3	97·2	65·5	1·86	62·7	251	97	2	39·4	783	259	33·0
6 hrs. @ 60° + 5 min. @ 121°	97·0	87·0	1·94	84·7	339	6	0	1·8	994	11	1·1	99·0	72·5	1·37	69·2	277	8	0	2·9	930	25	2·7
,, @ 125°	98·0	83·3	1·22	79·7	319	6	0	1·9	957	11	1·2	99·0	75·0	1·50	75·0	300	8	0	2·7	949	16	1·7
,, @ 127	97·5	83·7	1·51	85·5	342	9	0	2·6	939	18	1·9	99·0	70·0	1·11	72·7	291	8	0	2·8	985	19	1·9
,, @ 129	96·5	85·3	1·58	86·7	347	0	0	1·7	913	13	1·4	98·0	78·3	1·49	74·5	298	14	0	4·7	994	35	3·5
,, @ 131°	97·5	77·7	1·51	77·2	300	11	0	3·6	776	26	3·3	95·0	77·3	1·71	74·5	298	16	0	5·3	957	43	4·5
,, @ 133	97·5	82·3	1·62	76·2	303	3	0	1·0	783	3	0·4	98·0	71·5	1·82	68·2	273	8	0	2·9	860	19	2·2
,, @ 137°	86·5	78·0	1·32	72·0	288	4	0	1·4	712	7	1·0	92·5	71·0	1·62	69·7	279	16	0	5·7	807	40	5·0
Control	85·5	73·5	1·46	68·5	271	63	10	26·6	626	161	26·2	97·2	70·3	1·18	62·0	248	117	3	48·2	715	285	39·8

* Three rows only.

1–320 method, while it increased the number of plants and heads produced, gave slightly less effective disinfection than the 1–320 solution without the presoak.

(5.) Hot-water treatments: Soaking in water held at 104° F. for from four to twelve hours failed to disinfect the seed, though the percentage of smut which developed was reduced, especially at the ten- and twelve-hour periods. No apparent injury was done to the seed. Dipping the seed for ten minutes at temperatures ranging from 121° F. to 137° F. gave interesting but rather contradictory results. With the Garton variety, giving in the adjacent untreated control 29·6 per cent. of smutted heads, the sample dipped at 121° gave 1·9 per cent. smut; at 125°, 0·3 per cent. smut; at 127°, 129°, 131°, 133°, no smut; while at 137° again appeared 1·1 per cent. smutted heads. With the Dun variety the results are still more irregular, for only at 129° and 133° is the smut eliminated, though the highest amount showing at the other temperatures is only 1·4 per cent. smutted heads, against 23·6 per cent. in the adjacent untreated controls. No apparent injury was done to the seed. Presoaking the seed for six hours at 60° F., followed by dipping for five and ten minutes at temperatures ranging from 121° F. to 137° F., in no case gave complete control of the smut.

Both species of oat-smut, *Ustilago levis* and *U. Avenae*, were present on all the samples used in the experiments, the former species greatly predominating, but no difference could be detected in their reaction to the various methods of treatment.

EXPERIMENTAL METHOD.

Material. — Three lines of naturally smutted oats were used, two being of the Garton variety from different localities and the other of the Dun variety. All were harvested in 1925. Both *Ustilago levis* Magn. and *Ustilago Avenae* Jens. were present on all three samples.

Treatment. — Samples of about 1,000 seeds from each line were treated as follows:—

Copper carbonate: No. 1, Corona Coppercarb—dusted at rate of 6 oz. per bushel. No. 2, Stauffer's—dusted at rate of 3 oz. per bushel.

Colloidal copper (manufactured by the Pittsburg Plate Glass Company, U.S.A.): Dusted at rate of 4 oz. per bushel.

Semesan: Dusted at rate of 2 oz. per bushel. Steeped for two hours in 0·25 per cent. solution and dried.

Corona 640: Steeped for two hours in 0·25 per cent. solution and dried.

Uspulun: Steeped for two hours in 0·25 per cent. solution and dried.

Germisan: Steeped for half-hour in 0·25 per cent. solution and dried.

Clarke's Wheat Protector: Kept moist for thirty minutes with 7·3 per cent. solution.

Bluestone: Steeped for ten minutes in 1 per cent. and 2 per cent. solution copper sulphate, then kept moist for thirty minutes.

Formalin: Steeped for ten minutes in 0·3 per cent. and 0·2 per cent. solution of 39 per cent. formaldehyde, then kept moist for thirty minutes. "Presoaked" method consisted in soaking the seed for six hours in water, followed by ten minutes steep in 0·3 per cent. formalin, then kept moist for thirty minutes.

Controls: From the same bulk samples untreated.

The Clarke's Protector, bluestone, and formalin samples were treated on the same day as sown; the other treatments from ten days to a week before sowing.

Sowing.—The seed was sown 2 in. apart, 100 seeds to a row, rows 1 ft. apart. Four rows were sown of each treatment, and two rows of untreated control, except in the hot-water series, where four rows were used for control. Each row was divided during counting into four sections, on which the percentage germination was estimated separately, the probable error of the mean percentage being computed by Bissel's formula $P_E = \pm 0{\cdot}6745 \sqrt{\frac{\Sigma d^2}{n\ (n-1)}}$. Sowing dates, 16th to 26th October, 1925. First count, 24th to 26th November, 1925. Plants finally pulled, 19th to 24th January, 1926.

For fuller particulars of materials and methods see this *Journal*, Vol. 30, pp. 302–13.

The writer wishes to thank the following for assistance given during the experiments: Mr. N. R. Foy, the Department's Seed Analyst, and his assistants, Messrs. Cooch and Traill, who carried out the laboratory germination tests; Mr. J. McKay, Manager, Ashburton Experimental Farm, who prepared the land, netting, &c.; Messrs. D. W. McKenzie and D. McKay, who assisted in counting; and the managers of the National Mortgage and Agency Company, Ashburton; Wright, Stephenson, and Co., Invercargill; J. E. Watson and Co., Gore; and the Canterbury Seed Company, Christchurch, who supplied without charge the samples of oats used.

Forest Entomology.—In the course of his foreword to the State Forest Service bulletin "Forest and Timber Insects in New Zealand," Mr. David Miller remarks: "In the past, forest entomology has been neglected in New Zealand, and although at present there are insufficient data available, except in some isolated cases, from which a computation can be made of the actual loss due to insects, there can be no doubt that a very appreciable amount of depreciation takes place, the full extent of which will be recognized, and a great deal of it prevented, only when a better knowledge of the forest and timber insects in the Dominion is at hand. A review of the forest history of such countries as Europe and North America will reveal that the annual loss directly due to insect depredation is enormous; and we have ample evidence that the same condition prevails, and has prevailed, in this country both in our native forests and exotic plantations."

Electro-culture Investigation.—The work carried out at Rothamsted, England, since 1918 has shown that under field experimental conditions an increased yield of 20 per cent. on the average may be expected when certain spring-sown cereals are subjected to high-tension electrical discharge, also that under both field and pot experiments electrification has accelerated reproductive growth (grain) much more markedly than vegetative growth (straw).

THE PROGRESS OF ECONOMIC ENTOMOLOGY IN AUSTRALIA AND NEW ZEALAND.

Presidential address to the Biology Section of the New Zealand Institute Science Congress, Dunedin, January, 1926, by Dr. R. J. TILLYARD, Cawthron Institute of Scientific Research, Nelson.

IN this address I have purposely excluded references to the progress of economic entomology, except *en passant*, in other parts of the world, but have just as deliberately included Australia—firstly, because the attempt to deal with that progress in the whole world would occupy far more time than can be devoted to this address, and, secondly, because the problems of Australia and New Zealand are inextricably interwoven, and if we turn our eyes away from Australia we shall fail to learn half our lesson. An apple-orchard in Australia and an apple-orchard in New Zealand possess far more points in common than they possess differences. Ecologically, one is no more a part of Australia than the other is a part of New Zealand, but both are little pieces of Old England transplanted to a new environment, with the same old pests—codlin-moth, woolly aphis, and the rest of them—and the same problems of cultivation, spraying, picking, and marketing. The new environment, however, modifies the conditions to a considerable extent in so far as there are soil and climatic differences to be considered and a certain number of pests native to the country added to those brought in from outside. The same is true of a pine forest or of a dairy farm; it is not, ecologically, a bit of New Zealand or Australia, but an exotic development upon a native soil very differently occupied until the white man came on the scene. It is a piece of *disturbed country*, like that of a nation through which the scourge of war has passed. Never again can it settle down to its original condition, and never can it continue in the artificial condition apportioned to it by man unless he himself is prepared to give it constant supervision and attention. In respect of any such piece of ground innumerable problems—agricultural, chemical, horticultural, entomological, and mycological—press upon him for solution, and the final success of his experiment depends on how he is able to deal with them.

Now, in this address I propose to examine the progress which has been made in recent years purely as regards entomological problems only, and to try to indicate the lines on which future progress must be made. In doing this I shall divide the subject into two main sections —namely, (1) the control of injurious insects, and (2) the utilization of insects to control noxious weeds.

I. THE CONTROL OF INJURIOUS INSECTS.

The outstanding feature of the past few years, to my mind, has been the marked increase in the application and success of the biological method of control of injurious insects by means of their natural enemies, both parasites and predators. Only six years ago, at the First Imperial Entomological Conference in London, there were more speakers opposed to this method than in favour of it, and the great majority were in

a position of doubt, not knowing what to think about it. This was inevitable, of course, in so conservative a centre as London and in view of the backward state of entomology in the Empire as compared with America. The best speech in favour of the biological method was made by a visitor, Dr. L. O. Howard; and I am not ashamed to own, for my part, that he carried me with him entirely, and that I am now an enthusiastic supporter and worker for this method. New Zealand already owes more to Dr. Howard than to any other living entomologist, for it was through him that we have been enabled to introduce a number of most valuable enemies of some of our worst insect pests and to make marked progress in the work of establishing them permanently within the Dominion.

One of the curses of entomology, as, indeed, of all branches of science to a greater or less degree, is facile generalization from insufficient facts. My experience with biological control leads me to state here that no generalizations are worth anything in this particular case, for the simple reason that the amount we know about the habits and psychology of insects is so small compared with the vast amount still unknown that there is only one safe method of procedure—namely, to test every case on its own merits and as thoroughly as possible.

To illustrate this I will outline the recent history of the control of woolly aphis in New Zealand and Australia. There are in America, the original home of the pest, three types of insects concerned in its natural control—namely, (1) certain syrphid flies, (2) the ladybird *Hippodamia convergens*, and (3) the chalcid wasp *Aphelinus mali*. As closely similar syrphid flies already exist in New Zealand I did not make any attempt to introduce the American species. In considering the other two all the evidence was in favour of *Hippodamia*. This ladybird has a wonderful record in California, and is rightly looked upon as one of the most valuable of known beneficial insects. Large sums of money are spent in rearing, collecting, and distributing it, and every fruitgrower is fully convinced of the benefits it confers upon him. *Aphelinus mali*, on the other hand, is not thought much of. Moreover, it had already been introduced into South Africa, where it was a failure. Anybody with a ready faculty for generalization might have been tempted to concentrate on *Hippodamia* and write *Aphelinus* down as foredoomed to failure. I confess that I was on the verge of making this decision, when a conversation with a Canadian scientist on the apparently unrelated subject of biological strains or races gave me a new idea about it. We were studying two races, exactly similar morphologically, of a small dipteron, one of which lived only on one host plant and was of economic importance, and the other lived on an entirely different host plant and was of no economic importance whatever. In spite of apparent absence of morphological differences, experiments proved that you could not make the progeny of the one race live on the host plant of the other, and *vice versa*. My Canadian friend wanted to argue that they were therefore distinct species; but I would not agree, and countered his argument by asking him what he would do in the case of two morphologically similar races of a single species, one living, say, in a cold climate, on a given host plant, and having a single brood annually, and the other living in a much warmer climate, on the same host plant, but having two or three broods a year. The argument was left unfinished, but it suggested to my mind that the

value of a beneficial insect might be greatly increased in a new country if, instead of introducing consignments from one locality only, two or three localities with widely different climates were to be selected, and the biological races received from these were to be crossed before liberation in the new country. With this end in view I arranged with Dr. Howard to send supplies of *Aphelinus mali* from three States—Connecticut, Georgia, and Arkansas—having very different climates. We have no evidence that any progeny containing the Georgia strain survived the first winter, but individuals from the other two strains were observed to pair, and their progeny was recovered in the following spring from the tree on which they were placed. It will always be a matter of some doubt how far this crossing has been responsible for the success of *Aphelinus mali* in New Zealand, but that it has been *one* of the factors making for success I feel certain.

At the present time woolly aphis is well under control in New Zealand owing to the work of this parasite, which has proved of the greatest help to orchardists throughout the Dominion. *Hippodamia convergens*, on the other hand, though liberated in thousands throughout the Nelson Province, has not since been seen or heard of, and it is probable that this insect's known habit of seeking the tops of high mountains on which to hibernate has proved its undoing in New Zealand and in every other country in which it has been tried.

The New Zealand strain of *Aphelinus mali* has been sent across to Australia, and has already done splendid work in the apple districts of the States of Queensland and Western Australia, while the latest reports show that it is beginning to make its mark in the other States, where its propagation was greatly hampered by severe quarantine restrictions. The same strain has also been sent to South Africa, where it will be interesting to note whether it does any better than the original pure strain introduced there some years ago.

I think it may be claimed that *Aphelinus mali* is the first case of outstanding success with an *internal parasite* of an injurious insect present in New Zealand. In the case of predators—*i.e.*, beneficial insects which prey upon their host from outside—two marked successes at least had been obtained previously in New Zealand by the Department of Agriculture—namely, *Novius cardinalis* in controlling cottony cushion scale, and *Rhizobius ventralis* in controlling blue-gum scale. Of these, the experiment with *Novius* is now of long enough standing for us to be able to answer the oft-repeated question, "What happens to the beneficial insect when its host is exterminated?" In the Nelson District cottony cushion scale was practically exterminated for a number of years, and *Novius* disappeared with it. But the cottony cushion scale had one refuge where *Novius* either failed to follow it or only followed it tardily—namely, on gorse—and from this refuge, when the local population of *Novius* was almost extinct, the scale has again made its appearance and spread abroad on to wattles, kowhai, boronia, and other plants. At the present time this pest is doing quite a fair amount of damage in Nelson, and a room has been set apart in the Cawthron insectaria to rear it and to study its enemies further. Not only *Novius cardinalis*, but a small fly, *Cryptochaetum iceryae*, attacks the cottony cushion scale, and both of these can be made use of for the control of this pest when required

The question may be asked here, Is the internal parasite preferable to the external predator in the control of a pest? The answer I would give is that again we must not generalize, but must take each case on its merits. Other conditions being equal, we should not be biased in favour of one or the other, but should be prepared to utilize that one which shows best, by experiment, its ability to exercise control of its host. In the case of orchards, however, or other areas which are regularly sprayed, it is obvious that the internal parasite will have an advantage over the external predator, since the latter may well be killed by the spray, while the former will, at any rate, escape during part of its life when it is sealed safely up within the body of its host.

The success with *Aphelinus mali* was the direct result of the sending by the New Zealand Government of a representative to the First Imperial Entomological Conference in London. Five years later, in June last, a second similar Conference was held, and New Zealand again sent a representative in the person of Mr. J. G. Myers. This brilliant young entomologist has already justified his mission by the discovery of internal parasites of the pear-leaf-curling midge, *Pirrisia pyri*, and the first supplies of these insects are already in the hands of Mr. David Miller, the Government Entomologist. This is another case of a most serious pest to orchardists, and one which defies all attempts to control it with sprays. I am sure you will all agree with me when I say that we hope Mr. Miller will have with these little insects a success as great as that which attended the introduction of *Aphelinus mali*.

I now wish to bring before your notice two related problems in the biological control of insect pests. One of these is illustrated by the work done with the Australian ladybird, *Cryptolaemus montrouzieri*, in the control of mealy bug in orchards, and the other by the attempt to introduce into New Zealand the chalcid wasp, *Habrolepsis dalmanni*, for the control of oak-scale, *Asterolecanium variolosum*. In the first case it is found that, even in the comparatively warm climate of California, the ladybird starts too late in the season to make any impression on its host. But if the ladybird is reared artifically in warm insectaria it can be sent out in great numbers earlier in the season to all points where mealy bug threatens to become a serious pest, and in this manner the pest is regularly checked. What is true of California has been proved true of New Zealand, both by Mr. Miller and myself. But neither he nor I have a staff of assistants large enough to enable us to carry on work of this sort and at the same time to attend to the numerous other pressing problems which are calling for solution. We may state definitely at the present time that if mealy bug becomes in any given season a serious pest in New Zealand the early and abundant distribution of *Cryptolaemus* ought to be undertaken in order to check it as soon as possible. Fortunately, our New Zealand climate is not so favourable to this pest as is that of California, and an exceptionally severe winter, like that just past, gives it a severe set-back. At present there is very little mealy bug in Nelson orchards, but it is highly probable that the pest will reassert itself after two or three more favourable seasons.

The other problem is one of considerable scientific interest—namely, the difficulty of dealing with insects which reproduce parthenogenetic-

ally when introducing them into a new country. In the case of *Habrolepsis dalmanni* nothing was known of its life-history when the attempt to introduce it into New Zealand was first made; but we now have enough evidence to make it highly probable that in the case of this chalcid, as in some other Hymenoptera, the unfertilized females produce males only, while the fertilized females produce either wholly or mostly females. Now, you will appreciate the delicacy of the situation when you learn that, after repeated trials with consignments of oak-scale from which few or no parasites have been obtained, the last lot received by the Cawthron Institute has yielded a single male and no less than 427 females emerging over a period of more than a month! If the progeny of these become acclimatized in our insectaria and emerge in the spring of the present year it will all depend on that solitary male whether we shall get a mixed brood or an immense number of males only. If the latter event happens, then that is again the end of the attempt. The only solution seems to be to time a further consignment from America in such a way that the females derived from it may pair with the males derived from the present lot of 427 females. And even then our difficulties are not at an end, for if we overdo the business, so that *all* these new females become paired, we may obtain only females at the next brood, and only males from the second brood following! You will see from this how great a difficulty parthenogenesis introduces into these economic problems, and how delicate must be the balance in nature which, in its natural habitat, enables an insect like *Habrolepsis dalmanni* to continue year after year without running out entirely to one sex or the other. The very fact that from one consignment of oak-scale only a single male was obtained to 427 females shows how nearly, even in a state of nature, such an insect can come to extermination in one locality or another, and suggests to us that it may possibly be only by the interaction of a number of thriving colonies that we shall at last attain success.

While on this subject of parthenogenesis I may as well mention a second instance due to it of failure to establish a beneficial insect in New Zealand. Three years ago the Cawthron Institute received from Dr. Imms, Chief Entomologist of the Rothamsted Experimental Station, England, a consignment of cocoons of the well-known pear-slug *Caliroa limacina* parasitized by the ichneumon fly *Perilissus luteolator*. In the spring of 1923 not a single insect emerged from these cocoons, but a year later, during a much wetter spring, a number of pear-slug adults emerged, followed by about forty of the parasites, both sexes being represented. Most of these were liberated in the insectarium, with a plentiful supply of well-grown pear-slugs on small plum-trees, while a few were set free on two cherry-trees in the open. In both cases the ichneumons were seen feeding on the slimy exudation of the pear-slug, and the females were observed attacking them and laying their eggs in them. But it is sad to relate that every single ichneumon which has appeared in our cages this season has been a male. Either *no pairing* took place between the males and females of last year's brood, and the unfertilized females attacked the pear-slug, laid their eggs in them, and have produced only male progeny, or else *all* the females paired and produced male offspring only!

One lesson to be learnt from the above-mentioned failure is the great difficulty of obtaining success with small consignments. One might think at first that the liberation of, say, ten males and ten females would be practically certain to ensure pairing. This is not so. In many cases females and males of the same species do not even frequent the same places or have similar habits, and their meeting and pairing may only take place when certain fixed conditions of feeding and maturation have been fulfilled. What these conditions are in the case of *Perilissus* is not known. We hope to continue the attempt to introduce it, but it is clear that very much larger initial supplies will be needed for success.

It is inevitable in the case of experiments such as these that a large percentage of failures should be recorded. Some of these are absolute failures, without a single redeeming feature, as in the case of *Hippodamia convergens*. Others, like those cases of parthenogenesis mentioned above, are failures from which we may learn valuable lessons with which to pave the way to future success. There are many causes of failure which are not within the control of the workers themselves. One of these, a very sad one, I have to record in the case of the attempt to introduce parasites of the earwig into New Zealand.

The European earwig, *Forficula auricularia*, is, as most of you know, a serious pest in New Zealand, particularly in Otago. In the Central Otago orchards it is the worst pest of stone-fruit present. The Imperial Bureau of Entomology in London took up this question, and arranged with Dr. Imms at Rothamsted for a student to be given complete charge of this work. Mr. H. M. Altson was selected, and as a result of his work initial supplies of two parasites were sent out to the Cawthron Institute. These consisted of 120 puparia of *Digonochaeta setipennis*, and, later on, 1,400 live earwigs stated to be parasitized with *Racodineura antiqua*. Owing to the great difficulty of the work, a continuance of supplies over at least two whole years was essential. But, unfortunately, Mr. Altson fell ill, and there was nobody who could carry on the research. We now learn with the greatest sorrow that his illness is quite incurable, and that he will never again be able to take up this important work.

As this question of control of the earwig is of special interest to Otago I hope I may be pardoned for discussing it somewhat more fully. The insects mentioned above, the only two parasites known which are likely to offer a chance of successful control, are both flies of the family Tachinidae, and neither of them is easy to handle under insectarium conditions. *Digonochaeta setipennis* is larviparous, depositing young living larvæ in the haunts of earwigs; these larvæ move rapidly about, seeking for their prey, the latter showing evident signs of fear in their presence and hiding in dark corners. When the young *Digonochaeta* larva reaches an earwig it bores into it and feeds on its internal tissues, finally issuing fully fed from the destroyed host and forming the usual barrel-like puparium near its remains. In the case of *Racodineura antiqua* the procedure is very different. The females seek out leaves and vegetable remains which have been nibbled by earwigs, and deposit on them minute, black, seed-like eggs. These are swallowed by the earwigs, and the young larvæ hatch out

inside them and devour the internal organs of the host, finally pupating much as in the case of *Digonochaeta*. Under insectarium conditions we succeeded in taking both these flies through two complete broods, but we were not able to keep the percentage of parasitism high enough to ensure success of the experiment. The second brood in each case consisted of so few individuals, emerging at wide intervals apart, that the work could no longer go on without fresh supplies. Further, in the case of *Racodineura* it was noted that only eighty out of the original 1,400 earwigs sent from England yielded puparia—*i.e.*, the amount of parasitism was under 6 per cent. This percentage dropped still lower when we worked with Nelson earwigs.

One unexpected difficulty was met with in the case of *Racodineura*, but was overcome by the ingenuity of Mr. Tonnoir, who was at that time working in the Cawthron Institute as research student in Diptera. The earwigs were given slices of potato or apple to nibble, and when these were put into the cages where the fertilized females of *Racodineura* were confined the latter laid a great number of eggs on them. The slices were then returned to the earwig-cages, when it was found that the earwigs ate them readily enough, but left each little egg standing up on a high pinnacle untouched! This most unexpected set-back was countered by Mr. Tonnoir, who, knowing the fondness of earwigs for dandelion-leaves, tempted them with these. They fed readily enough, and the flies laid their eggs on the nibbled pieces; these, when returned to the earwig-cages, were finally devoured, and thus parasitism was at last secured.

The experiments with these two flies appear to indicate that, given adequate supplies to start with, and working as close as possible to nature—*i.e.*, not with closed cages in insectaria, but with baited traps in the open, into which the earwigs could be attracted by hundreds—*Racodineura* and possibly also *Digonochaeta* could be permanently established in New Zealand. But whether either of these flies, or even both together, will give a sufficiently high percentage of parasitism to control the pest to any great extent our experiments do not enable us to say. The attempt must certainly be made, and it will be one of the principal objects of my forthcoming visit to America and Europe to try to arrange for abundant supplies of both parasites in the near future.

New Zealand is the only large area of land in the world, exclusive of the frigid zones, in which the green lacewings, family Chrysopidae, are not represented by native species. These insects feed on various species of aphids; their larvæ have peculiarly formed sucking mouth-parts and are very voracious. In most parts of the world they are only sporadically beneficial, owing to the large number of parasites from which they suffer. If these insects could be acclimatized in New Zealand without their own parasites it seems highly probable that they would prove of very great benefit in the control of a number of introduced aphids, such as those of pine, spruce, and oak. Attempts have been made from time to time to introduce various species of Chrysopidae into New Zealand from America and Australia, but all have failed from one cause or another. More recently a large shipment of 1,900 hibernating green lacewings has been received by the

Cawthron Institute from Canada, through the co-operation of the Dominion Entomologists in Ottawa and the State Entomologists of British Columbia. These insects arrived in excellent condition, only about fifty being dead. A large number were sent down immediately to Christchurch in order to make an attempt at controlling the oak-aphis. Both in Nelson and Christchurch a considerable number of eggs were laid, and the larvæ hatched from them are at present feeding vigorously on various species of aphids. Further consignments are being arranged for in the near future.

The problem of saving the oaks in Canterbury is a difficult one, as it appears to be the damage done by the combined attacks of oak-aphis and oak-scale which is the cause of their serious condition. The solution to be aimed at must be efficient control of both these pests. This should be attained to a large extent by the successful acclimatization of both *Habrolepis dalmanni* and a suitable species of *Chrysopa;* but there is still a considerable way to go before this desirable end is achieved.

The codlin-moth, *Laspereysia pomonella*, is, as you all know, one of the worst pests which orchardists have to contend with in all parts of the world. Only the most careful and rigid attention to the spraying schedule will ensure to an orchardist freedom of his crop from the injury done by it. In New Zealand there are known to be two distinct broods of this moth, and the main effort of the orchardist is in the direction of getting his arsenical sprays on to the trees at the right times to check the newly-hatched larvæ of these two broods before they can enter the apples. Recent observations, however, indicate that there is a more continuous succession of moths throughout the summer than is generally supposed. The two broods are, in fact, only the crests or maxima of the wave-like curve on the graph indicating the number of emergencies week by week from October to May. Two entomologists in the University of Colorado discovered a few years ago that codlin-moth could be easily trapped by means of fermented apple-juice placed in jars hung in the upper third of the trees. This experiment has been repeated recently in a Nelson orchard, and also by a South Australian grower. Both got closely similar results, which are rather remarkable when we consider that the experiments were carried out on clean orchards where codlin-moth has been controlled by careful spraying for many years.

In the Nelson orchard fifty-five small tins were used, hung between the upper limbs of consecutive trees in one section of the orchard. During November and December, when the experiment was being carried on, high winds prevailed nearly all the time, a most unusual state of affairs for Nelson. A number of tins were blown about violently and their contents spilled, so that the total recorded falls short of the actual catch. The supply of apple-juice gave out on the 23rd December. For the period of seven weeks the following catch was secured: Number of codlin-moth, 305, of which 218, or 72 per cent., were females; number of leaf-roller moths, 198; number of other insects, 5,468, of which 7 per cent. could be classed as beneficial, the rest being either injurious species such as cut-worms, &c., or of no account.

In the South Australian experiment sixteen large tins were used, and four of these were placed near a neighbouring orchard whose owner had neglected to spray carefully. In three weeks during the latter part of November and first part of December 442 codlin-moth were caught, 66 per cent. being females. More than half of these were trapped in the four tins near the neglected orchard!

I mention these results particularly on account of the recent outcry in Great Britain against the sale of apples having arsenical sprays on them. At the present moment there does not appear to be any reason to think that New Zealand apples which have undergone the full spraying programme will come under the ban. The scare, however, has started, and I think we ought to be considering whether we might not reap a great advantage by substituting either a spray harmless to man, or else a trapping method for the later sprays in January and February, which are the ones which leave arsenic on the exported apples. The country which could place the label "No arsenical spray on these apples" on all exported cases of that fruit would undoubtedly reap the benefit over other countries in higher prices and a more ready market. So I shall express the hope that next year some groups of orchardists will take up this question of trapping more extensively and carry on larger experiments right through from one end of the season to the other.

You will see from the above account that much has been done in the past few years towards an increase in our knowledge of economic entomology in New Zealand, particularly as regards the biological method of control of insect pests. There is, however, a hundred times as much left undone, for lack of the trained men and resources needed to carry out the work. Even the preliminary work, such as the working-out of life-histories, is still undone in the case of some of our worst pests. The valuable work done by Mr. David Miller in his study of the life-history of the pear-leaf-curling midge and the New Zealand grass-grub must form the essential basis on which any scheme of attack on either of these two pests must be built up. The life-history of the New Zealand bronze-beetle is still to a great extent unknown. Many examples could be given of pressing pioneer work which badly needs to be done.

(To be continued.)

Farmers' Field-days.—Writing on a field-day held at the Merredin State Farm, the editor of the *Journal of the Department of Agriculture of Western Australia* thus defines a farmers' field-day: "It is an annual exposition of results from patient effort harnessed to trial, experience, experiment, and condition; an education in a nutshell; bovrilized farm science. It is a gift from the Government of the day to its husbandmen of knowledge painstakingly acquired, and a plan scientifically designed for the opening-up and development of fields and pastures to the limit of the State's soil and climatic capacity. It is also a sign-post at the cross-roads of success and failure."

Forty per cent. of the bulk of a fertile soil should be air and not stagnant water. Oxygen in the soil is necessary for the establishment and maintenance of the highest-class plants that a soil will carry. Drainage provides oxygen to water-ridden soils.

MANUFACTURE OF WHEY BUTTER.

FAULTS AND HOW TO REMEDY THEM.

J. W. SMITH, Dairy Instructor, Palmerston North.

THE making of whey butter as a by-product of cheese-manufacture is now generally adopted in New Zealand; for the year ended 31st March, 1925, a total of 1,290 tons was graded at the various ports. Special regulations under the Dairy Industry Act deal with the manufacture and branding of whey butter. All packages containing the product must be clearly branded as such. Any butter made from a mixture of whey cream and fat separated from milk must also be branded "whey butter."

Whey contains from about 0·15 to 0·3 per cent. of fat, but no definite percentage can be stated, as this varies according to the richness and the acidity of the milk, and more particularly with the carefulness of the cheesemaker in handling the curd. Since the introduction of centrifugal separators it has been possible to skim the whey very exhaustively, and there is no consistent reason why the fat derived from the whey should not produce a butter equal in quality, or nearly so, to that of ordinary first-grade creamery butter (scoring 90 points), provided that the whey is skimmed promptly after it leaves the cheese-vat, and that the whey cream is properly pasteurized and cooled before it is churned. Factory-managers and buttermakers are apt to treat this valuable by-product with a certain amount of indifference. On the other hand, it is a fact that during past seasons some factories which paid particular attention to the manufacture of their whey butter received within 1s. per hundredweight of creamery-butter prices.

It is regrettable to note, however, that on the whole during the past few years the quality of our whey butter has been going back. This can be attributed to the following reasons: (1) Saying the whey from the cheese-presses; (2) insufficient care and cleanliness of the plant; (3) inefficient and out-of-date plant; (4) lack of experienced operators.

Although frequently practised, the saving of the whey from the presses is not to be commended, and the method of collecting the fat which drains from the presses overnight and putting it into the bulk of the whey to be separated must be condemned. Insufficient care and cleanliness of the plant are the cause of the majority of faults in our whey butter to-day. Managers and dairy companies would be well advised to take a much keener interest in this branch of the work when their whey butter is placed second grade. As regards inefficient and out-of-date plants, it is surprising to find many of our leading factories poorly equipped for whey-butter making. Lack of experienced men to operate the plants is commonly met with. Except in cases where a permanent whey-butter maker is employed, one generally finds the latest addition to the staff in charge of the whey-separator and butter-making. This is decidedly unsound, for the inexperienced man in a great many cases costs double his pay in the wear-and-tear of separator parts (such as from over- or under-oiling), loss in fat-separation, loss in moisture, salt, and fat content of the butter, and very often a resultant low-scoring butter.

TREATMENT OF THE CREAM.

Assuming now that all the foregoing defects have been remedied, and it is desired to manufacture a first-grade whey butter, I would recommend in the first place that the separator-screw be set to secure a whey cream containing from 45 to 50 per cent. of fat, so as to permit the addition of a large amount of water or milk to the cream before pasteurizing. The manufacture of whey butter at a cheese-factory differs somewhat from that manufactured at a butter-factory. At a cheese-factory, where milk is plentiful (and the demand for the yield is not excessive), I would recommend the maker to break down with milk the percentage of fat in the whey cream to 36 to 40 per cent. and to pasteurize immediately after separating, adding to the cream before churning, if need be, any surplus starter that may be over from the cheesemaking department. Where the cream is held at the cheese-factory overnight before railing to the butter-factory it is advisable to pasteurize it up to about 175° F., taking care that this temperature is reached in not longer than twenty minutes, carefully agitating with a metal plunger during the heating process, and immediately cooling the cream down as low as possible. This checks the acidity and assists to eliminate some of the volatile flavours.

At a butter-factory, where milk is less plentiful, I would recommend the maker to break down the percentage of fat in the whey to 36 to 40 per cent. with pure clean water, check the acidity, and neutralize down with bicarbonate of soda to about 0·13 of acid "off the cooler"; then pasteurize the cream to about 192° to 204° F. No set rule as to pasteurizing-temperatures can be stated; this must be determined by the maker, as the condition of the cream and local conditions vary. Immediately after pasteurizing cool the cream down, and, if possible, add at least 5 per cent. of pasteurized milk to the cream in the vat. A good, clean, lactic starter can be added with advantage to the cream before churning; care, however, must be taken so that the maximum acidity at churning is not more than about 0·15 of 1 per cent.

CHURNING AND WORKING.

No set rule as to churning-temperatures can be stated, as they also vary according to local conditions. However, the buttermaker should remember that whey butter has a greater tendency than ordinary butter to soften when exposed to atmospheric temperatures; consequently the churning-temperatures should be sufficiently low to obtain a good, firm-bodied butter. If the churn is driven at the correct speed and is not overloaded, the churning should break in from twenty to thirty minutes. The churn should be stopped when the granules are still small; the grains should not be as large as when churning creamery butter. Particular care should be exercised in the washing of the granules. After practically all the buttermilk has run off, spray about two to three buckets of chilled water (according to the size of the churning) over the butter from the front of the churn by placing the hand over the hose-pipe; then allow this water to drain off. Now add the wash-water proper, sufficient to float all the granules; then put the churn on the high gear and spin for at least fourteen to twenty turns. After the wash-water has drained off open up the churn, and again spray over the granules sufficient chilled water to ensure that all

traces of sediment are washed out; then salt the granules, again close the churn door, and spin on the high gear for at least twenty turns. Now insert the butter-worker, and work the butter with both taps closed until the moisture content reaches, say, 15 per cent. The churn should then be stopped, allowing all surplus brine to drain off, and the butter then worked up to a finish, which may take from three to five minutes, according to the working of the churn. A final moisture-test should be taken, which should show a gain of ½ per cent. in water content.

There is in buttermaking an art and a knack which requires perhaps years of experience and judgment, and cannot easily be taught by rule of thumb or by written directions by those who have mastered the art for themselves. We find buttermakers drawing their supply of cream from the same district, working upon similar temperatures, &c., yet one maker's finished product is easily worth one point higher in grade. The reason for such a difference is obvious: one maker knows when he has made butter, the other man does not know.

The body and texture of much of our whey butter is open to improvement. Professor O. F. Hunziker, in commenting upon the body and texture of butter generally, states: "A well-made butter has an influence upon the flavour. This should not be interpreted to mean that the make and flavour are entirely dependent on one another; they are not; defects in the one are not infrequently accompanied, if not caused, by certain defects in the other. For instance, fermentations that cause the protein elements to surrender their jelly-like colloid character, which precipitates the casein into contracted, hard, dry particles, making proper moisture incorporation difficult and necessitating excessive working of the butter, which in turn tends to injure the smooth and waxy body which is most desired. There is always this tendency when butter is made from a very high acid cream. Faulty working does interfere with the flavour, and may impair the keeping-qualities of the butter. The working of the butter deals with the natural and mechanical causes and the effects, while the flavour and keeping-quality have to do with the bacteriological and chemical agencies and reaction. In order to obtain perfection of one you must necessarily have a certain amount of perfection in the other. The body and texture of butter are to a large extent controlled by a great variety of factors; some are beyond the control of the buttermaker, over others he has a partial control, and still others, while under control, require his constant attention and adjustment according to local conditions and seasonal changes." It is for this reason that no definite set rule as to pasteurizing and churning temperatures can be laid down to suit all factories.

MOISTURE, FAT, SALT, AND CURD CONTENT.

Speaking generally, whey-butter makers do not attach sufficient importance to this branch of the work. It would appear, in respect to the moisture or water content, that as long as it does not exceed the legal limit in butter forwarded to the grading-stores they are satisfied. Given modern appliances and sufficient labour to conduct the buttermaking, it is not unreasonable to expect buttermakers to turn out whey butter similar in composition to creamery butter. The best made creamery butter to-day contains on the average about 15 per cent.

of water, 1½ to 2 per cent. of salt, 1 per cent. of curd, and 82 per cent. of fat. In practice it is by no means uncommon to find whey butter containing 12 per cent. of water and from 84 to 85 per cent. of fat.

The overrun from fat in whey in many instances must be much lower than it need be. If 1·75 per cent. of fat is allowed for manufacturing-losses, the overruns of butter containing from 82 to 85 per cent. of fat are as follows: Butter containing 82 per cent. fat, 19·81 per cent. overrun; 83 per cent., 18·37; 84 per cent., 16·96; 85 per cent., 15·58. The difference between a 19·81-per-cent. and a 15·58-per-cent. overrun is 4·23 per cent., and, valuing butter at 1s. per pound, is equal to 0·5d. per pound of butterfat in whey cream. It will be recognized that due attention to this branch of the work is profitable to manufacturers of whey butter.

FLAVOURS IN WHEY BUTTER.

Characteristic flavours in whey butter and their probable causes may be described as follows:—

Whey flavour: Butter made solely from fat skimmed from whey which has passed through clean drains, whey-tanks, and subsequent utensils is not at all objectionable in flavour.

Oily flavour: Very similar to cod-liver oil. Probably due to saving the press-fat, having too high a fat content in the cream, pasteurizing at too high a temperature, or holding at a high temperature for too long a period, and not churning often enough. This class of flavour is often noticeable in highly coloured butter (the result of making coloured cheese).

Mutton-fat flavour: Probably due to using a thick cream insufficiently broken down, high churning-temperatures, and washing with excessively low-chilled water.

Cheesy flavour: Suggestive of saving the press-fat, which has been tainted by the rough, whey-soaked cheese-caps and by passing down a dirty press-chute.

Dirty flavour: The most objectionable flavour is the real dirty flavour due to leaky whey-tanks or drains, or to insanitary conditions existing in some part of the plant.

GENERAL.

Poor-quality whey butters have a tendency to become tallowy, while the butter sometimes becomes white and lardy in appearance during storage. Our London Inspector, Mr. Walter Wright, reports that whey butter can always command a market if the quality stands up to first-grade marks, but that inferior quality is always difficult to dispose of. This goes to indicate that a successful buttermaker must be cleanly about his work, both inside and outside of the factory, keeping accurate records of his work and a constant eye on the raw material as well as the finished product.

Handling of Cream for Buttermaking.—This season many dairy companies have been collecting their supplies of cream at more frequent intervals than heretofore, and the trend is to get the cream delivered in a fresher, sweeter, and cooler condition. Also the general practice now is to proceed with the pasteurization and cooling of the cream immediately on receipt at the factory.

LIMING AND TOP-DRESSING EXPERIMENTS IN MARLBOROUGH.

OBSERVATIONS FOR 1925–26 SEASON.

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IN an article published in the *Journal* for September, 1925, it was pointed out that the soil of the Spring Creek experimental plots could safely be regarded as typical of a large number of the heavier soils on the Wairau Plain, while that of the Koromiko plots could be deemed representative of flat country in the Sounds district.

THE SPRING CREEK AREA.

The paddock on Mr. W. H. Gane's farm at Spring Creek, 12½ acres in area, was first sown down in rye-grass and red clover in March, 1923. The Department laid out plots and commenced liming and top-dressing operations during the winter of 1924. Top-dressing with fertilizers was repeated in July, 1925, but no lime has been applied since the winter of 1924, the amount then used being 2 tons per acre.

The object of this test, as was stated in the previous article, is to ascertain just how long a red clover and rye-grass paddock may be made to hold with liming and top-dressing, under the usual treatment of haying, seeding, and stocking. The common practice in the Spring Creek district (and in most districts for that matter) has been to plough up such a paddock after a period of three years. Of course, it is generally recognized that after one or two hay-cuts the rye-grass tends strongly to disappear.

The Spring Creek plots are now in their third season, one season having elapsed before any manure was applied at all. The question that remains to be solved is whether or not liming and top-dressing will enable the carrying-on of stands of clover into the fourth and successive years on a payable basis. The winter of 1924 was a dry one, that of 1925 a wet one. This has had the result that in the low-lying portions of the paddock, which are not well drained and are at the same time difficult to drain, the clover has died out. When this exception has been allowed for, it may be said that the paddock has improved materially through top-dressing. Expressed on a percentage basis, the green weights (taken twenty minutes after mowing) may be expressed as follows: If the average of the weights taken from the control plot be represented by the number 100, then the average of the limed plots equals 100; 1½ cwt. super per acre, 300; 2 cwt. super, 322; and super and lime, 356. From sixteen to twenty weighings were made from each method of treatment.

From these figures it will be seen that lime alone has so far shown no advantage; 1½ cwt. superphosphate per acre has shown an advantage of 200 per cent. over no manure, a most convincing result; 2 cwt. superphosphate per acre has shown an advantage of 222 per cent. over the untreated plots, while it also shows a suspicion of an advantage of 7 per cent. over a dressing of 1½ cwt. per acre. It is noteworthy that there was a perceptible difference in the field so far as the pro-

lificacy of growth of the 1½ cwt. and 2 cwt. super plots was concerned. The percentage difference in weights, however, is too small to be significant. Superphosphate and lime show an advantage of 256 per cent. over the control plots, and suspicion of an advantage, again, of 10 per cent. over superphosphate alone. Most of these results, in spite of a wet winter followed by severe dry conditions in the spring, must be regarded as of quite a decisive nature. Although the advantage of super over the untreated plot in the preceding season was as much as 146 per cent., that advantage has been increased this season by about 110 per cent. over the control plot. Lime and super together last season proved of about equal value. It would seem, however, that this season there is almost sufficient evidence to enable us to say that superphosphate and lime together have proved slightly better than has superphosphate alone.

VIEW ON THE SPRING CREEK AREA.

Left—plot dressed with lime and super; right—lime alone, and control plots.

In addition to the slightly favourable evidence gleaned from weighings, it must be remarked that on the plots treated with super and lime the sward of clover was much thicker than on those treated with super alone. Moreover, rib-grass was much more prevalent on the latter. It would appear that while lime alone has shown no positive result, its use with superphosphate may be regarded as beneficial. It must be observed, moreover, that it has taken two seasons to show this result.

A second test as to the efficacy of various fertilizers was also conducted on the Spring Creek area. In this trial manures containing nitrogen seem to have shown little or no positive result, thus indicating that nitrogen is not a deficient factor in such soils so far as the establishment and maintenance of clover stands is concerned. The other manures tried were (1) ground rock phosphate, (2) a half-and-half mixture of ground rock phosphate and superphosphate, and (3) superphosphate alone—all applied at the rate of 2 cwt. per acre. If the average of weights from the control plot be represented by the

number 100, then super alone equals 271; rock phosphate with super 271, and rock phosphate alone 114.

It would appear from these results that superphosphate alone and Nauru phosphate mixed with superphosphate have given practically the same results—namely, a distinct advantage (when experimental error is allowed for at the rate of 10 per cent.) of something like 160 per cent. If allowance be made for experimental error we see that the advantage from rock phosphate alone is only slight—namely, 4 per cent. Consequently there is room for doubt as to whether or not the ground Nauru rock phosphate mixed with the superphosphate has had any part in producing the results detailed here.

Generally speaking, owing to an extremely wet winter followed by an extremely dry spring, the bulk of fodder produced was considerably less than in the preceding season, when a dry winter was followed by a wet spring.

(To be continued.)

BUTTER-BOXES MADE OF FOREIGN TIMBER.

During the present and the preceding season quite a number of New Zealand dairy companies have been using foreign timber for packages for export butter. Experiments and dairy-company experience have proved that butter held in many of these packages has turned out in a condition which raised no objection that has reached us. Other experiments and consignments have been less fortunate, and far too many reports have been received from London indicating that New Zealand butters packed in such boxes have been adversely affected. In these instances the taint of the wood has been imparted to the butter next to the inside of the box, and, as the period of storage extends, the taint of the timber becomes more pronounced and permeates farther into the block of butter.

There have been instances where the taint, although detectable, has not caused commercial loss. Other cases have occurred where the monetary loss has not been great, but in these instances it is doubtless the case that the prestige of New Zealand butter has been prejudicially affected. Our latest advice is to the effect that one company's butter purchased by an overseas buyer has already caused a loss running into approximately £2,000. One of the butter-boxes which contributed to this loss was returned to us from London. The timber of this box contained a number of pockets of resin which were so pronounced in odour that it was no wonder the butter had been badly tainted. One pocket, although barely discernible, and easily passed without notice, was found, when opened, to contain almost a teaspoonful of such resin or gum.

In view of the fact that there has been no particular kind of foreign timber used respecting which we have not had complaint in connection with tainting, and recognizing that the qualities of such timber imported have not evidenced that uniformly satisfactory condition which is necessary to ensure invariably satisfactory delivery of our butter in Britain, dairy companies will be well advised to give the question of purchase of butter-box material more serious consideration in future.

—W. M. Singleton, Director of the Dairy Division.

FODDERS AND SUPPLEMENTARY FORAGE CROPS FOR DAIRY-FARMERS.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, Auckland.

INTRODUCTORY.

GRASS is the main crop of the New Zealand dairy-farmer. The soils, the climate, and other natural conditions obtaining in the Dominion favour the growth of grass. The climate is mild generally, and healthy for live-stock, which can be kept all the year round in the open. With few exceptions the rainfall is good and well distributed. Over a large portion of the North Island the annual rainfall exceeds 50 in., while over the remainder it ranges between 30 in. and 50 in. The west-coast region of the South Island has a rainfall ranging from 70 in. to upwards of 100 in. a year. The eastern portion, including the Canterbury Plains (between 20 in. and 30 in.), is drier, but has a satisfactory rainfall, while the southern districts range up to 50 in. It is calculated that two-thirds of the rain falls at night, thus allowing plenty of sunshine. New Zealand is therefore favoured. Ample sunshine, copious rain, and other natural advantages combined promote the production of succulent pasture, which is the sheet-anchor of our farmers.

It is recognized that the best and cheapest food for farm animals is good grass. The area of the Dominion devoted to grassland of all classes is about 70 per cent. of the whole occupied area, while nearly 90 per cent. of the total cultivated (improved) area is in sown pasture. This is the clearest testimony of the reliance the farmer in New Zealand places on grass.

But, excellent as the best pastures are, too much reliance is usually placed on grass, particularly by the dairy-farmer. Those familiar with farming conditions know that he often exploits his grassland to a degree harmful alike to the pastures, the stock, and in turn to himself. There are certain periods when the pastures need supplementing. In mid-winter the grass is at low productivity generally, while under dry summer conditions it becomes innutritious for dairy cattle. It is thus mainly during the winter and the late summer and autumn periods that extra feed must be provided to adequately meet the requirements of dairy stock. Even on farms where the pastures are first class and the best pasture and stock management methods are practised supplementary feed is essential. Moreover, it pays to provide the extra feed.

NEED FOR MORE HAY.

As there is a surplus of grass on the pastures during the flush period an adequate quantity of hay should be saved from this excess. Farmers would do well to provide at least 10 cwt. of hay per dairy cow. Only a little over 1 per cent. of the total area of grassland in New Zealand is cut annually for hay. If all this hay were fed to the dairy cattle alone it would provide less than 5 cwt. per cow. The hay provision is thus totally inadequate. This is a matter that should receive the serious attention of our dairy-farmers. It would be difficult to beneficially replace hay with any other winter fodder.

Good meadow hay containing grasses and clovers provides a well-balanced food for stock. Temporary pastures of 25 lb. Italian or Western Wolths rye-grass with 6 lb. red clover per acre make good hay. Permanent pastures are better left for grazing. Lucerne and clover also provide hay of high feeding-quality. It may be repeated that our dairy cows need at least double the amount of hay at present saved. A provision of even 15 cwt. per dairy beast would be desirable.

WINTER ROOTS AND ENSILAGE.

In addition to hay, roots generally make up the winter bill of fare on New Zealand dairy farms. Swedes, turnips, mangolds, and carrots are chiefly relied upon. Ensilage has been coming more into favour of late years. It can to a large extent replace roots where root crops prove uncertain. Ensilage keeps well and can be fed to cows, which milk well on it during dry spells or at other times when succulent feed is scarce. There is a wide choice of crops for ensilage. Grass presents little difficulty to the beginner who wishes to try ensilage. In the many dairying districts good yields from turnips are found to be more difficult to secure, because of damage done by pests and diseases; hence the increasing attention given to ensilage.* For the same reason mangolds are being more widely grown by dairy-farmers, especially on the smaller holdings.

Where swedes can be successfully grown, particularly on the larger farms and in newly-broken-in country, they are difficult to excel. Hard-fleshed turnips sown in February or later may also be used to provide winter feed. Mangolds and carrots give a further choice of roots.

Successful mangold-growing entails labour in cultivation. The cost of producing a good crop is higher than for swedes or turnips. However, farmers should remember that the yields of mangolds per acre are heavy compared with other root crops. Mangolds resist drought well, and they can be fed through the winter and well into the spring, producing no taint in the milk. They make excellent food for dairy cows, pigs, poultry, and other stock. They are easily assimilated, and in the warmer and drier parts of New Zealand they should be grown and fed to a greater extent by dairy-farmers. They leave the ground clean for the succeeding crop.

Where soil conditions favour carrots, this crop is often grown with success. Free-working loams with a free subsoil are suitable. Carrots provide autumn and winter feed for dairy cows. Horses, especially those receiving much chaff and grain, are benefited by a ration of carrots.

Reliable authorities place the roots referred to in the following descending order as regards their feeding-value: Sugar-mangolds, carrots, ordinary mangolds, swedes, and turnips.

SUCCULENT SUMMER FORAGES.

During dry spells, frequently experienced after December, when the ordinary pastures almost stop growing and become unpalatable, green

* The subject of ensilage is treated in detail in the Department's Bulletin, No. 80, "Ensilage and Silos"; free on application.

crops are especially valuable. In the paspalum areas of the Auckland Province this grass is almost wholly depended upon to supply the necessary summer feed for stock.

In certain districts, such as Hawke's Bay and Marlborough, and under irrigation in Otago, lucerne thrives particularly and can be grazed. In other places, where lucerne can be grown only with careful attention to approved methods of maintenance, it can be cut three to four times in the season. It therefore supplies green feed and hay, and the early cuts provide silage, each and all of which have a valuable place on the farm. The high nutritive quality of lucerne is widely known. For the average dairy-farmer whose farm is well improved, lucerne should certainly occupy an area of 5 to 10 acres or more, according to his requirements. Green lucerne should be wilted before being fed. Where grazing is practised, it should be grazed after milking and only for short periods. Stock should not be put on when it is wet. In dry weather ensilage, already referred to, provides good fodder relished by stock. It causes no taint if fed properly.

There is a wide range of crops which can be grown to supply summer feed. Stock like variety; it not only helps to ensure good health but greater production. The crops to be grown must be selected according to the requirements of the farm and with due attention to local conditions. The district, its climate and the soil, will influence to a large extent the choice of crops.

NOTES ON FORAGE-CROP PRODUCTION.

It must be understood that the information and advice relating to forage crops which follows is of a general character. Individual farmers, with their local knowledge, may have to modify the amounts of seeding or the manurial prescriptions given. However, the notes should prove helpful to many farmers and others who wish to have some practical guidance.

With good, well-managed pasture there is an increase of the humus in the soil, and the upkeep of soil-fertility is an easy matter; but so soon as land is devoted to cropping a loss of fertility may quickly ensue unless attention is devoted to the principles and practices of good tillage. In preparing an area for cropping the soil selected should have satisfactory drainage. If a pasture is to be broken up it is often found convenient to take a grass sward which is run out. Better results will be gained from a pasture in good heart, with plenty of clover in it. More humus is provided by the extra organic matter in the turf. This adds to the fertility of the soil, helping in retaining soil moisture for the crop, improving the texture, and giving a source of nitrogen.

Where the soil is at all heavy in nature early preparation is particularly advised. Regarding the actual time to plough the soil, no hard-and-fast rule can be laid down. The seasonal rainfall will largely determine it, especially on soils which set hard. Discretion must be used, especially if the season is wet and the soil heavy. Lighter soils, which may be worked at almost any time, present no great difficulty and do not need long fallowing. If the soil is turned up and allowed to lie exposed to the weather during the winter months much good will result. If a second ploughing is to be done, the first

one should be shallow. On lighter soils ploughing in the spring is time enough. Such soils leach if laid up to the bare fallow where rainfall is copious. If ploughing is done early a catch-crop is advisable, as it makes ready use of the soluble foods in the soil. Where twitches have to be eradicated well-worked fallows are necessary to clean the land.

Attention should be given to approved rotational methods and thorough preparation of the seed-bed. Liming is often found beneficial. It corrects sourness and provides a base for useful small forms of life in the soil, while legumes and other crops with a high lime-requirement benefit greatly where lime is applied. Burnt lime is useful for improving the physical condition of heavy soils.

Too heavy a sowing often gives much poorer results than a light seeding, as the plants, being too close together, become stunted. Heavy land will require more seed than light land. In a loose seed-bed more seeds become buried and fail to germinate than in a well-consolidated one. The superior crop seen on the headlands can often be ascribed to no other reason than the better consolidation of the seed-bed there. Often the partial failure of a crop is due to faulty preparation of the land, and the need for thorough and early cultivation and a well-consolidated seed-bed free from air-spaces, undecayed vegetable matter, and large clods cannot be emphasized too strongly.

In the matter of manures only a general outline can be given. The mixtures mentioned are only for general conditions, and must be suited to local needs. The necessity for nitrogen in the manure often depends on the quality of the soil, more being required on one poor in vegetable matter than one rich in that ingredient. In many places, especially on light soils, much of the superphosphate recommended can be replaced by basic super and bonedust.

MANGOLDS.

Mangolds will thrive on most soils other than those of a thin, hungry nature. They thrive best in deep loams well supplied with vegetable matter. Clay loams give good crops provided they can be brought to a fine seed-bed.

Mangolds do well after grass, owing to the large amount of vegetable matter stored in the soil. A pasture as free as possible from weeds should be selected. The cultivation must be early and thorough to have the vegetable matter well decayed and the seed-bed well consolidated before sowing. The usual procedure is to plough early in the winter and cross-plough again in the early spring. If the ploughing out of grass is left till early spring the turf must be thoroughly broken up, a month or two before ploughing, by heavy disk harrows or a disk plough. On heavy land it is often a good practice to plough in the autumn, set the land up in ridges, and allow it to weather during the winter; then cultivate, roll, and work down to a seed-bed in spring. Liming with burnt lime assists in promoting tilth under such conditions.

The usual sowing is 4 lb. per acre of seed having a germination of 130 to 140 per cent. The "seeds" being really fruits, the crop must be hand-thinned. The practice sometimes followed of raising plants in a seed-bed and planting out later helps in giving the crop a clean start free from weeds.

Varieties: Long Red is a heavy cropper and is suited to heavy land; also it is the hardiest sort, but does not keep as well as the globe varieties. Yellow Globe and Prizewinner Yellow Globe are standard varieties. These give a good yield and keep well. Golden Tankard gives a medium yield and is very nutritious. New Sugar is a nutritious variety, while Jersey Queen is a popular one. White Knight is a variety coming into favour. It is a good practice to sow alternate rows of long red and globe varieties.

It is often the practice to steep the seed in soft water for ten to twelve hours, then allow it to dry for another ten hours before sowing. This gives good results, provided the ground is not very dry at the time of sowing, in which case the seed germinates with the absorbed water, and, there not being sufficient moisture in the soil to carry the plant on, it often dies. If uncertain of the weather it is well to sow 2 lb. of soaked seed and 2 lb. of dry seed.

Sowing is best done in October, in wide drills, either on ridges or on the flat. The distance usually varies from 24 in. to 30 in. On heavy land the combined ridger and sower brings the clods to the top of the ridge, where they form a bad seed-bed. In this class of land it is better to set up ridges with a potato-ridger (double mouldboard plough), sow half the manure in the bottom of the ridges, and split the latter back over the manure, then sow the seed with a combined ridger and sower having the disks removed. When sowing on the flat, broadcast half the manure and sow the other half with the seed.

Any well-rotted stable manure available should be applied to the land before ploughing. Artificial fertilizers should be used at the rate of 4 cwt. to 6 cwt. per acre. On a small area intensely cultivated a slightly heavier dressing would be beneficial. For a deep loam well supplied with lime the following mixture would give good results: Superphosphate, 4 parts; sulphate of ammonia, 1 part; kainit, 2 parts. On light soils half the superphosphate could well be replaced by bonedust or blood-and-bone. If kainit is not used, 3 cwt. to 5 cwt. of agricultural salt should be applied before sowing, and sulphate of potash or some other potash salt used in the mixture.

Mangolds respond well to intercultivation with the horse-hoe. If they are grown on ridges it enables the work to be commenced much earlier than when planted on the flat.

Before feeding, mangolds must be lifted and stored in a pit to ripen. If fed while still growing or in an unripened state they are liable to cause scouring. In many instances, also, serious cases of tympany and abortion have occurred, allegedly due to feeding green mangolds. If the roots are not pitted they must be pulled and allowed to lie for at least a fortnight before feeding. To be quite safe, a month is necessary for dairy cows and six weeks for pigs. It is advisable to pull the tops off and leave them in the field, as they are of poor feeding-value, though they contain considerable amounts of manurial constituents. The tops from an average crop of mangolds contain as much fertilizer as is contained in 4 cwt. to 5 cwt. of blood, 1½ cwt. sulphate of potash, and 1 cwt. superphosphate.

When pulling mangolds care must be taken not to break them or they will bleed. For the same reason the tops should not be cut, but twisted off as the mangolds are pulled.

For feeding, 40 lb. to 50 lb., together with hay, is a sufficient ration. In the spring, if the mangolds in the pit happen to be growing, they should be fed carefully.

The general principles for the cultivation of other root crops are much the same as for mangolds, with the following particular differences :—

CARROTS.

Carrots make a splendid forage for milking-cows in the late autumn and early winter. Best results are obtained from a deep sandy loam with a free subsoil.

If sown in 14 in. drills and unthinned 1 lb. of seed is sufficient. In 21 in. or 28 in. drills sow 2 lb. to 4 lb. of seed and hand-thin. It is a good plan to mix the seed with damp sand several days before sowing, to stimulate the seeds to germinate and so get ahead of the weeds. The crop should be sown at the same time as mangolds, and be inter-cultivated. The same manurial mixture as for mangolds can be used, with half part of sulphate of potash substituted for the kainit.

Red varieties are slightly more nutritious than the white ; Sinclair's Champion and Magnum Bonum are those usually sown. Among white varieties, White Belgian grows high out of the ground and is a heavy yielder ; Matchless White is a heavy yielder and easily lifted.

A ration of 30 lb. to 35 lb. of carrots per beast per day is sufficient. Carrots keep well in the ground.

TURNIPS AND SWEDES.

Turnips and swedes do well in most soils, but are best suited to good loams. Acid conditions in the soil encourage club-root disease.

Turnips usually follow grass, and the land should be ploughed early (June or July) and worked down to a fine well-consolidated seed-bed before sowing.

White turnips are sown from October to March. For February and March feeding sow at the end of October or beginning of November. Imperial Green Globe is the best variety for general purposes ; Purple-top Mammoth, Devonshire Greystone, Red Paragon, and Lincolnshire Red Globe are quick growers for early use.

Yellow-fleshed turnips are sown from November to February. The yellow-fleshed varieties are more robust, slower in growth, and of superior feeding-value to white turnips, but they do not stand dry conditions as well. Green-top Aberdeen is a handy sort and a good keeper ; Purple-top Aberdeen is grown for early use.

Swedes are sown from November to January. Superlative is one of the best varieties—a high yielder, good keeper, and of excellent feeding-value ; Elephant, Champion, John Bull, Best of All, and Magnum Bonum are good standard varieties. Sowings are as follows : Drilled in 14 in. rows, 8 oz. to 12 oz. ; ridged in 28 in. drills and thinned, 1 lb. to 2 lb. ; broadcasted, 1 lb. to 2 lb. per acre.

Phosphatic manures are essential for turnips and swedes, and part at least of the phosphates should be soluble. Superphosphate is particularly good because it contains sulphur, which is beneficial to turnips, in addition to soluble phosphate. For soft turnips on good loams use 1½ cwt. to 2 cwt. basic superphosphate ; on poorer and

lighter soils, 1½ cwt. to 2 cwt. basic super and 1 cwt. bonedust. Swedes may be given the same manures as for turnips, but they require 1 cwt. to 1½ cwt. more per acre.

Swedes and turnips should be fed off in breaks. The average requirements are about ½ cwt. per head of cattle per day. When feeding to cows in milk the turnips should be pulled the previous day, allowed to wilt in the sun, and fed out in a clean grass-paddock immediately after milking. Wilting for a day and a half is best. For cows, 30 lb. to 40 lb. a day is sufficient. Overfeeding of turnips is the main cause of taint in milk. Another cause is feeding diseased turnips, especially where cows are turned on to the crop.

RAPE.

Conditions regarding cultivation are similar to those for root crops. Rape has a deep tap-root which goes into the subsoil, thus improving it for subsequent crops. This crop can be used on the dairy farm mainly for pigs, or to cows not milking. Most crops, especially grass, do well following rape. It does well on most soils, but best on good loams; it is usually taken after grass.

Sowings are as follows: In 7 in. drills, 2½ lb.; in 14 in. drills, 2 lb., per acre. Dwarf Essex and Broad-leaved Essex are suitable varieties. The time of sowing depends on the time when the stuff is required. The first sowing should be three and a half months before it is needed for grazing.

Fertilizers should be selected according to the quality of the soil. A freezing-works mixture having a composition of about 2·5 per cent. insoluble nitrogen, 10 per cent. soluble tricalcic phosphate, and 20 per cent. insoluble tricalcic phosphate, at the rate of 4 cwt. per acre, should have good results. About 4 oz. to 8 oz. per acre of mustard should be sown with rape.

KALES.

The cultivation, manuring, &c., of kales is similar to rape, but they should be sown in 28 in. drills and intercultivated.

Thousand-headed kale is more a holding than a fattening crop, providing a large amount of feed in summer, autumn, and early spring. Before feeding off in the spring, on land that is at all heavy, the crop should be moulded up to prevent the stock puddling the land and making it consolidated.

Buda kale is slightly more nutritious than Thousand-headed kale, but lighter in yield.

Chou moellier or marrow-stemmed kale is a giant, thick-stemmed kale, growing 4 ft. to 6 ft. high. There are two varieties, Green-stemmed and Purple-stemmed. It does not give as much feed as Thousand-headed kale, but it is quite a nutritious crop. It should not be fed to dairy cows in milk if rotten leaves are on the stems, as they cause milk-taint. It is best cut, wilted, and fed out to the herd.

CEREAL MIXTURES.

Cereals such as oats, barley, rye-corn, &c., provide good supplementary feed. Short green oats particularly, and oats mixed with a

legume or Skinless barley, provide excellent winter and early spring grazing for milking-cows before the grass comes away.

For these crops the land should be ploughed during December, and a thorough cultivation should be given during February and March with the disks, cultivators, harrows, and roller. The land should be worked until in fine tilth and really good order for sowing the seed. Under ordinary conditions this will be about the first week in April, or as soon as there is sufficient moisture in the land to ensure a good germination.

The following combinations and sowings per acre are recommended, according to local conditions :—

John Brown wheat, 90 lb. ; Scotch tares, 60 lb.
Purple-straw Tuscan wheat, 90 lb. ; Scotch tares, 60 lb.
Emerald rye-corn, 55 lb. ; Marquis wheat, 58 lb.
Emerald rye-corn, 87 lb. ; Scotch tares, 60 lb.
Algerian oats, 45 lb. ; Emerald rye-corn, 55 lb.
Algerian oats, 45 lb. ; Brown Skinless barley, 40 lb.
Algerian oats, 45 lb. ; Major wheat, 58 lb.
Algerian oats, 55 lb. ; Scotch tares, 60 lb.

For manure, use from 2 cwt. to 3 cwt. of superphosphate or basic superphosphate per acre. Add 1 cwt. of blood-and-bone where the soil-quality is not good.

These forages can be grazed, or they may remain to be cut and carted out to stock as required. Any balance of the crops not required for feeding can be utilized for ensilage, chaff, or hay, and will be found equally valuable for feeding to stock during the month of January following, or at any other time when required. An exception must be made in the case of rye-corn, which, when approaching maturity, becomes too tough for haying purposes. Cape barley should not be fed off after it comes into ear.

MAIZE, SORGHUM, AND MILLET.

These crops have their place, especially in the warmer parts of New Zealand. The cultivation and manuring given for rape should be followed, using 2 cwt. to 4 cwt. of the mixture mentioned ; or a mixture of blood-and-bone and super would have much the same composition. For late March, April, and May feeding, one or more of the crops in question should be sown at the end of November, and cut and carted out as required.

Maize provides good feed for cows, especially for putting the herd into a good condition to face the winter. Sow at the rate of 30 lb. to 60 lb. in 28 in. drills, or broadcast at the rate of 2 bushels per acre. Drilling is preferable, as it allows for intercultivation, which, under dry conditions, ensures a heavier yield. The seed should be sown at a depth of 1½ in., and guarded against birds. Suitable varieties are Hickory King, Ninety Day, and Early Red Leamington.

Sorghum is sown at the rate of 25 lb. per acre in 28 in. drills or broadcast. Suitable varieties are Planter's Friend, Early Ambercane, and Sorghum Saccharatum. Sorghum requires less moisture than maize to produce a satisfactory crop. This fact of drought-resistance should be borne in mind by farmers. Its cultivation is confined to

the warmer parts of the North Island. The same applies to Sudan grass. The only safe time for feeding off sorghums is at the full flowering stage. Stunted or frosted sorghum should not be fed.

Japanese millet is a good crop for dairy cows during dry autumn weather. It can be grazed when 6 in. to 9 in. high in breaks, or cut and fed out in the field. It does well when combined with red or crimson clover. By itself, sow 15 lb. to 20 lb. of seed per acre in 7 in. drills; or 10 lb. of millet with 8 lb. of clover.

CATTLE MARROWS AND PUMPKINS.

These are often used by dairy-farmers for winter feed. Sowing is at the rate of 2 lb. to 4 lb. in rows 6 ft. apart, which should be done as soon as the danger of frosts is over, usually about late October or November. Marrows are sometimes sown broadcast. Both pumpkins and marrows may be sown between the rows of maize, where this crop is usually grown. Field varieties include Mammoth cattle pumpkin and kumikumi. They can be fed on the ground like turnips, or, when mature, stacked and carted out and fed on the pastures.

SUMMARY.

(1.) Grass pasture alone, at certain periods, is inadequate for dairy cows.

(2.) Pasture must be supplemented by suitable fodders and special crops at lean periods.

(3.) The surplus grass in the flush can be made into hay and ensilage, which supply feed when a shortage comes.

(4.) More hay should be saved in New Zealand, and a wider use of ensilage would be a sound and beneficial practice.

(5.) Roots are the winter mainstay, but silage can to a greater or lesser extent replace roots where the growth of the latter is uncertain.

(6.) Succulent summer forages should, where found necessary, be grown and fed.

(7.) Good cultivation, attention to manuring, and other related matters on the productive side of cropping ensure successful crops.

In conclusion, it may be added that as the dairy cow has been aptly called the foster-mother of mankind she should at least be sufficiently fed at all times. The best cow can only do its best when adequately fed, and it pays to do this.

Infected Area at Waitara.—In connection with the discovery of cattle-ticks, the area of land at Waitara declared an infected place under the Stock Act has been extended, and is now defined as follows: All that area bounded by a line commencing at the sea at the mouth of the Waiongona River, following that river to the bridge on the Te Arai Road; thence by that road to its junction with the Waitara Road; thence by the Waitara Road to its junction with the Pennington Road; thence along that road to corner of Section 35; thence along the south-eastern boundary of Sections 35 and 36 to the Waitara River, across that river to the Waipapa Road; thence along that road to Elliott Road; thence by the south-western boundary of Subsection 2 of Section 41; thence by the southern boundary of Section 97 to the Nikorima Road; thence in a northerly direction along that road to the sea; and thence by the seashore to the mouth of the Waiongona River.

C.O.R. CLOSING LIST FOR YEAR 1925.

Dairy Division.

THE appended list, which completes the publication of records for purebred dairy cows which gained certificates in 1925, contains particulars of many performances worthy of special mention, but space restrictions preclude much comment.

It may be mentioned, however, that the cow Jewel's Mystery, which appears at the head of the Jersey mature class with 809·70 lb. butterfat, has three previous certificates of record, one of them being on a production exceeding 800 lb. butterfat. She was bred by Mr. J. F. Vosper, Matamata, in whose hands she gained her first two certificates. For some years, however, she has been owned by Mr. A. E. Watkin, of Takanini, and, through her progeny, should aid considerably in the making of the fine herd which this owner is rapidly developing.

Another outstanding individual in the present list is the mature Ayrshire, Sheilah's Favourite of Allandale, owned and tested by Mr. R. S. Weir, of Seaward Downs. Her record of 697·86 lb. butterfat entitles her to a place among our higher producing C.O.R. Ayrshires.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Hui Mai Glorina ..	J. Nicholson, Manakau ..	1 359	240·5	365	10,818·6	523·56
Craigalea Bonnie ..	J. G. Robertson, Eltham ..	2 4	240·9	365	8,706·5	494·71
Kelvin Belle ..	G. Buchanan, Paeroa ..	2 51	245·6	365	7,787·0	423·86
Raithwaite Favourite Belle	H. H. Buxton, Auroa ..	1 321	240·5	365	6,871·9	401·99
Meadowvale Devotion	E. O'Sullivan and Sons, Tariki	1 279	240·5	365	7,998·2	395·12
Tirohia Starlit ..	B. E. Veale, Tirohia ..	2 46	245·1	363	6,553·0	386·07
Twylish Mayflower ..	S. Shalfoon, Opotiki ..	2 39	244·4	365	6,609·5	385·03
Kelvin Velvet ..	G. Buchanan, Paeroa ..	2 40	244·5	365	6,775·8	382·05
Raithwaite Maid Molly	H. H. Buxton, Auroa ..	1 332	240·5	315	7,311·8	372·88
Grey Lady	S. Shalfoon, Opotiki ..	1 359	240·5	355	5,931·6	350·57
Holly Oak Beulah ..	Fred Phillips, Otorohanga ..	1 289	240·5	319	6,078·9	342·13
Waipuna Lena ..	H. C. Wallace, Tamahere ..	2 25	243·0	365	5,469·8	325·46
Raithwaite Charm's Lass	H. H. Buxton, Auroa ..	1 315	240·5	311	6,178·4	316·86
Rosehill Choice ..	W. C. S. Hosking, Waiuku	1 342	240·5	342	5,644·4	315·44
Tirohia Golden Emblem	B. E. Veale, Tirohia ..	1 364	240·5	339	5,549·5	281·28
Senior Two-year-old.						
Tirohia Superior ..	B. E. Veale, Tirohia ..	2 325	273·0	365	7,379·7	473·73
Wattle Berry ..	F. C. Ross, Kiwitea ..	2 339	274·4	365	6,005·2	336·73
Jocular Beauty ..	W. S. Carter, Palmerston North	2 313	271·8	365	5,968·0	328·96
Willowbank Lady May	Boon Bros., Whakatane ..	2 114	251·9	256	5,058·5	284·73

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk	Fat.
	JERSEYS—*continued.*					
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Majesty Mahone ..	C. Stevens, Maungatapere	3 194	296·4	352	9,430·2	550·72
Silver Glance ..	Brakenridge and Pearson, Taupaki	3 45	281·5	365	8,406·4	512·56
Marchioness Patricia	G. Hodgson, Whakapara ..	3 71	284·1	365	10,188·8	499·02
Huimai Nancy Jean ..	J. Nicholson, Manakau ..	3 45	281·5	336	7,747·0	461·39
Pine Grove Lily ..	John Luke, Clevedon ..	3 12	278·2	364	8,111·3	438·27
Golden Wattle ..	F. C. Ross, Kiwitea ..	3 40	281·0	304	6,705·5	403·02
Brooklyn Mary ..	H. J. Lancaster, Glen Oroua	3 305	307·5	365	8,168·0	401·01
Eileen's Winning Way	Brakenridge and Pearson, Taupaki	3 293	300·3	365	6,208·4	370·15
Lady Dudu ..	A. E. Watkin, Takanini ..	3 326	300·0	275	6,665·7	360·79
Four-year-old.						
Bellewattle	F. C. Ross, Kiwitea ..	4 341	347·0	337	7,900·5	427·09
Mature.						
Jewel's Mystery† ..	A. E. Watkin, Takanini ..	11 352	350·0	359	12,834·9	809·70
Charm's Lord's Fancy	G. Buchanan, Paeroa ..	7 141	350·0	365	12,270·7	581·42
Reid Park's Lizzie ..	W. C. S. Hosking, Waiuku	7 282	350·0	355	6,500·5	500·86
Basra	C. Stevens, Maungatapere ..	7 216	350·0	365	10,780·1	500·47
Lakeside Calm ..	V. W. Nowell, Hawera ..	6 346	350·0	365	8,052·8	515·32
Rata Bloom ..	B. E. Veale, Tirohia ..	6 292	350·0	365	8,805·2	507·08
Kentucky	K. M. Stevens, Maungatapere	8 318	350·0	350	9,431·1	505·16
Waipiko Priscilla ..	J. C. Hare, Cheltenham ..	6 25	350·0	365	10,805·1	495·43
Maxim's Maid Cherry	C. Stevens, Maungatapere ..	8 58	350·0	338	6,728·0	490·31
Butterman Banker ..	H. J. Lancaster, Glen Oroua	9 41	350·0	312	7,571·0	399·75
Lucky Dorothy Begonia	K. M. Stevens, Maungatapere	9 114	350·0	273	6,080·4	352·22
	FRIESIANS.					
Junior Two-year-old.						
Johanna Ormsby ..	W. Barton, Featherston ..	2 163	256·8	363	12,190·3	438·80
Senior Three-year-old.						
Queen Hengerveld Belle of Groteholm†	W. H. Staniland, Clandeboye	3 218	298·8	365	11,038·2	441·14
Junior Four-year-old.						
Ellesmere Eding Lassie†	W. H. Staniland, Clandeboye	4 120	325·5	346	11,483·5	437·86
Senior Four-year-old.						
Peria Claudia 1st ..	J. H. Wilson, Matamata ..	4 357	349·2	323	12,024·5	462·06
Mature.						
Rosevale Kittie Posch*	H. North and Sons, Omimi	6 0	350·0	365	22,690·4	713·97
Woodcrest Netherland Pauline†	Riverlea Land Syndicate, Hobsonville	7 88	350·0	365	18,056·2	650·02
Marlo Belgian Lassie	J. H. Wilson, Matamata ..	9 341	350·0	310	17,247·6	538·40
Selwyn Colantha Lass	W. H. Staniland, Clandeboye	6 39	350·0	347	12,771·0	451·22
Manola Empress* ..	Matangi Friesian Farm Co., Matangi	8 65	350·0	199	10,402·9	442·07
Dutch Juno* ..	Matangi Friesian Farm Co., Matangi	5 88	350·0	213	12,238·0	422·73
Hengerveld Belle Segis†	Riverlea Land Syndicate, Hobsonville	10 28	350·0	324	10,551·8	374·76

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		MILKING SHORTHORNS.				
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Pine Farm Letty 2nd A†	J. Parkinson, Opotiki ..	2 101	250·6	365	10,402·8	373·16
Willowbank Tangi's Milkmaid 3rd	J. W. Robinson, Runciman	2 23	242·8	340	7,584·2	328·21
Willowbank Tangi's Beauty 2nd	J. W. Robinson, Runciman	2 48	245·3	334	7,167·3	306·73
Willowbank Tangi's Favourite 2nd	J. W. Robinson, Runciman	1 279	240·5	325	6,583·9	286·57
Three-year-old.						
Willowbank Tangi's Wincy	W. H. Simms and Son, Christchurch	3 14	278·4	305	11,790·5	498·93
Mature.						
Pukekite Rangi* ..	R. King, Buckland ..	..	350·0	269	13,365·1	621·71
Pukekite Queen* ..	R. King, Buckland ..	..	350·0	313	11,807·8	498·51
		AYRSHIRES.				
Four-year-old.						
Ivanhoe Dairymaid*	A. M. Weir, Menzies Ferry..	4 28	316·3	320	11,737·3	436·01
Mature.						
Sheilah's Favourite of Allandale*	R. S. Weir, Seaward Downs	9 339	350·0	365	15,206·2	697·86
Little Nell of Frewdale*	A. M. Weir, Menzies Ferry	6 10	350·0	365	13,413·2	563·80
Perfection of Ivanhoe*	A. M. Weir, Menzies Ferry	6 339	350·0	365	13,372·0	549·62
Molly Bawn of Ivanhoe*	A. M. Weir, Menzies Ferry	7 1	350·0	365	12,578·6	511·62
Myra of Townhead*	R. S. Weir, Seaward Downs	6 329	350·0	365	11,712·5	502·60
Ivanhoe Brownie* ..	A. M. Weir, Menzies Ferry	5 28	350·0	324	10,587·5	386·90
Iris 4th of Townhead*	R. S. Weir, Seaward Downs	6 311	350·0	267	9,473·0	380·66
Ivanhoe Miss Russell 2nd*	A. M. Weir, Menzies Ferry	12 13	350·0	364	12,720·8	487·66
		RED POLLS.				
Two-year-old.						
Dominion Lady Lallah	Central Development Farm, Weraroa	2 10	241·5	327	6,442·0	284·42
Three-year-old.						
Dominion Table Top	Central Development Farm, Weraroa	3 346	311·6	333	9,185·6	410·39
		Second-class Certificates.				
		Jerseys.				
Four-year-old.						
Waipiko Clarissa ..	C. G. C. Dermer, Cheltenham	4 344	347·9	365	11,160·6	641·85
		Milking Shorthorns.				
Junior Two-year-old.						
Glenthorpe Daisy 3rd†	A. J. Melville, Buckland ..	2 71	247·6	365	10,220·8	506·95

SEASONAL NOTES.

THE FARM.

PASTURE TOP-DRESSING AND HARROWING.

WHERE the slower-acting phosphates, such as basic slag or any of the ground rock phosphates, are preferred, these should be applied as soon as possible if an early spring effect is to be obtained. On the other hand, where superphosphate is preferred and carting is difficult in early spring, or weather conditions unsuitable for application, super can be spread at any time during winter. The idea that phosphates wash or leach out is an erroneous one, as has been proved very conclusively.

Phosphatic fertilizers, also lime, are the first essentials on most New Zealand soils, and until the supply of these has been built up in the soil the use of either potash or nitrogen is a secondary consideration. Of the phosphatic fertilizers available the different forms are relatively valuable under varying conditions. Thus superphosphate, either mixed in the form of basic super or applied separately, is suitable for the drier soils, while basic superphosphate is especially good on soils of a peaty nature. Basic slag is advised for use on the heavier moister soils, and also on the stiffer volcanic soils, where it has given excellent results. Basic slag is also particularly good in building up worn-out pastures. Nauru rock phosphate as an autumn top-dressing has given good results on many soils in the North, especially stiff clays and other soils of a sour nature. It is especially useful where lime is costly and the cartage a heavy charge. A mixture of superphosphate and Nauru, either half and half or two of Nauru and one of super, is an improvement on plain Nauru, and makes an excellent general top-dressing for pastures where lime is lacking and is difficult or costly to apply. Suitable dressings of the various fertilizers, or mixtures, range between 2 cwt. and 4 cwt. per acre.

Both basic slag and a mixture of superphosphate with lime promote the growth of white clover, and are therefore particularly valuable in producing the best type of feed for ewes and lambs.

The coming month is a very good time for tripod-harrowing old pastures. The thorough harrowing of grassland periodically is one of the most important factors of pasture-management. It is observed that in many instances a light harrowing is considered sufficient so long as the animal-droppings are scattered; whereas one of the main objects—the invigorating of the old turf—can be effected only by thoroughly breaking the surface.

LIMING.

Lime, like the slower-acting fertilizers, is best applied in the autumn, so that it may become thoroughly incorporated with the soil during winter, and in a manuring scheme is of special value for preceding superphosphate. Lime is often applied in the hope that it will make wet land drier. This is a great mistake and a waste of good

material, for such land must first be efficiently drained before any good effect can be expected either from lime, manures, or cultivation. Where liming is not intended to be repeated in the near future, ground limestone should be applied at not less than 1 ton per acre, or ground burnt lime at from 10 cwt. to 12 cwt., on average soils. If an application is to be made every two or three years, however, dressings of from 6 cwt. to 10 cwt. per acre are quite satisfactory—in fact, are generally preferable to heavier applications at longer intervals.

AUTUMN SOWING OF OATS.

April and the early part of May is a good period for sowing oats for threshing or chaff, as the crop gets well established during the winter and is in a condition to make very rapid growth in the early spring. Oats sown at this period should provide one or two good feedings in the spring, and be ready to harvest from the middle to the end of December. Sowing should be at the rate of 2 bushels to 2½ bushels per acre. In the case of Algerians it is advisable to use seed produced the previous season, as new seed is often of low germination. Suitable manures are super or special grain mixtures at from 1 cwt. to 2 cwt. per acre.

In preparing the seed-bed for autumn-sown cereals the land should be worked to produce a good mould underneath, but the surface left rough. The clods provide shelter for the young plants during the winter and prevent the soil from running together too closely. The lumps can be broken down when harrowing in the spring to break the crust formed by feeding off and winter rains.

Loose-smut of oats is controllable by pickling, and the trouble is well worth while if the seed is not known to be clean. One method of proved worth is the following: Soak half-sacks of grain for seven minutes in diluted formalin solution—1 pint of commercial (40 per cent.) formalin to 50 gallons of water; allow to drain; and dry slowly. Sowing should be done the following day.

OAT VARIETIES.

The following notes may be useful as a guide to the selection of an oat suitable for its particular purpose and for district conditions:—

Garton: Garton's Abundance may be regarded as the best yielder and miller in New Zealand, and is the best all-round oat for the South Island, as Messrs. Garton are continually improving the strain. Gartons should not be fed off in the same way as Algerians and Duns. Generally, they should be fed off once only with a big mob for three to four days, and then the sheep taken away. If Gartons are fed otherwise the sheep tend to eat in patches and kill out some parts previously grazed, while other parts grow rank. Garton's Leader is popular in the Timaru district, but of recent years it has largely given way to Garton's Abundance.

Algerian: This variety is best sown in autumn. Popular as green feed; flag fine, abundant, and highly palatable, being preferred to Gartons by stock. Can be fed two or three times in autumn and spring. If it is to run to a grain crop, care should be taken not to feed too late. Canterbury-grown seed is always in demand in the

North Island for green feed. The grain-yield of Algerians is good, but the milling-qualities poor. The straw and chaff, however, are considered very palatable.

Dun: These must be sown in the autumn. The plant has fine leaves and a very spreading habit, so that the green feed tends to get dirty and be wasted. It makes very little growth until about early September, and then can be fed repeatedly till the end of October. The straw is fine and weak. The heads ripen from above downwards, so that the tip grain shakes while the straw is still green. The crop should be cut at first shake. The yield is high in good circumstances. The grain is in demand for racehorses.

Black Tartar: Best autumn-sown. Green feed plentiful, but not very palatable. Straw tall, coarse, and strong. Yield high on good ground, but falls off very rapidly on light land or in dry weather. Chaff is generally considered good.

Danish: This variety has an old Canterbury reputation as a good green-feed and chaff oat.

Potato, or Canadian: Can be sown in late spring, ripening under four months from sowing. Flag broad; cannot be fed off at all. Good milling-qualities and high yield, but rusts badly and shakes easily.

Ruakura: Should be autumn-sown. Green feed abundant. It is highly rust-resistant in some parts of the country, and is popular in several North Island districts, but is not favoured generally in Canterbury.

Sparrowbill: Spring-sown; grown chiefly in Otago. Broad flag; must not be fed off. Straw coarse, but head so heavy and compact that it often breaks about 18 in. from top. Milling-qualities good, and yield very heavy. This variety is mostly being replaced by Gartons.

Black Excelsior: Suitable for spring or autumn sowing. Tillers very little. Produces a thin crop even if sown thickly. Straw coarse and short, but very palatable. Yield of grain low.

IRRIGATION FARMING.

Where irrigation farming is practised in Central Otago every endeavour should be made during April to break up land intended to be sown in the spring. On dairy farms within the next month an area should be sown in Emerald rye-corn, at 2 bushels per acre, to provide early spring feed.

From now on preparations should be made to have contour ditches cut, leading water to those places in the various paddocks which during the past season have proved hard to irrigate; this particularly applies to undulating country. Low-lying parts of the paddocks which become flooded during the irrigation season should have open drains cut, so as to allow surplus water to be carried off to lower levels. Ditches can now be cleared while still soft, and all boxes which have become disrepaired during the season should have attention.

On low-lying more or less flat country which has not previously been brought under irrigation, ploughing and preliminary levelling should be carried out with a view to laying out the land in a series of

checks for border-method irrigation. This method requires well-levelled land, and much can be done in respect to such levelling at the time of autumn ploughing.

POTATOES.

From now on the main crop of potatoes will be ready for lifting, before winter rains set in. The tubers should be carefully sorted, and those intended for marketing later pitted dry on a well-drained piece of land, the pit being well thatched to keep out frost and winter rains. Potatoes intended for seed should be stored in a cool, dry, well-ventilated shed. The gratings in a wool-shed make an excellent floor for potato-storage.

—*Fields Division.*

THE ORCHARD.

EXPORT TRADE.

PICKING of the later varieties of apples will be engaging the attention of growers at this time, as the fruit has been maturing very fast. Every endeavour should be made to get the fruit away as soon as ready for picking. The safest course is to have all varieties on the water before the end of April. Should the season be an early one in the Northern Hemisphere our fruit would then be sold before the new fruits became plentiful. The Australian States and Tasmania are shipping heavily to overseas markets this season. The quantity of late varieties will probably be a record, and the experience of the last two seasons has been that the latest arrivals have not been so satisfactory to some growers as they expected. In some instances growers have themselves to blame, as the assembling has been too protracted. This year every effort should be made to get the fruit packed up to time, and so eliminate the risk of faulty condition on arrival at destination and the overlapping of the new season's fruits in Europe which was so detrimental to the sale of some of our late varieties last season.

STORAGE OF FRUIT FOR LOCAL MARKETS.

Growers should now give attention to the storage of apples for their local trade. The successful keeping of fruit over long periods is governed by the care taken to ensure this. The fruit must be picked as soon as matured, and placed in the cool store as soon after picking as possible. All fruit showing stem-punctures, insect-bites, and other injuries should be rigidly discarded from the cool-store pack. It is advisable not to wrap fruit for cool storage. Pack carefully, and fill the case well without bruising, and it will be found that upon packing out with paper later on there will be a gain in the number of cases for market, providing storage has been successful. It is not economical to pay storage on wrapping-paper, and the repacking is much quicker when dealing with unwrapped fruit.

Fruit intended for ordinary storage should be graded for quality and sizes as soon as picked, and stacked separately where it will be available when needed for order or auction. The large or faulty fruit can be dealt with first, thereby reducing waste to a minimum.

Be careful to keep out any fruits likely to rot; otherwise not only will the faulty fruit be lost but also several adjacent to it.

SPRAYING; COVER-CROPPING.

Late varieties of apples can be sprayed with lime-sulphur or bordeaux previous to picking for late storage, as a preventive of ripe-rot, bitter-rot, and black-spot development, &c. Cases should be treated similarly, where these have become soiled with rotting or diseased apples, before storing fruit away in them.

In orchards where the land is suitable for sowing beans, peas, or vetches for cover-crops, this work may still be carried out.

—J. H. Thorp, Orchard Instructor, Nelson.

CITRUS-CULTURE.

Seasonal work for the coming month in orange and lemon groves will be to thoroughly stir the land and clear it of weeds. Trim the lower branches of the trees so that none will be left to sweep the ground — a condition which favours the spread of lemon brown-rot. Spray with bordeaux, 4-4-40, as a precaution against this disease, followed by oil, 1–60, for scales and mites. If this latter spray is not applied before growth ceases for the season there will be danger of defoliation in the winter should the spray be then applied. On the other hand, if the spray is withheld for fear of defoliation scales will multiply to an extent sufficient to jeopardize the trees, and certainly result in a dirty crop. General orchard experience is decidedly in favour of a thorough autumn oil spraying as late as possible—that is, before the sap ceases to flow freely.

The land should be worked rather towards the trees, leaving a depression, if not a furrow, between the rows, with the line of fall to provide a get-away for surplus winter rains. This work is particularly necessary where cover-crops are to be grown during winter, as they can be left undisturbed without fear of the trees becoming waterlogged later. Lupins, or any other desired green crop, may be sown after a good rainfall. Sowing with the first autumn rains usually results in a good stand.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

FEEDING AND MANAGEMENT OF THE PULLETS.

Feeding and handling of the stock at the present time require considerable judgment on the part of the poultry-keeper.

The majority of the pullets will be exhibiting signs of coming to a laying-point, such as making a cackling noise, showing a red and more or less developed comb, a fullness in the abdominal region, and generally an adult shape. A common mistake, especially at this period of the year, is to provide a similar ration for all birds in the flock. The adult birds which it is not intended to breed from should be given different treatment from the pullets. In the former case a forcing diet should be provided, in order that every available egg may be secured before the moulting process takes place, and at a time when

eggs rule at a high level of value. On the other hand, the pullets should be given an ample but plain ration. This is in order to guard against the common weakness of forcing birds to maturity before they have attained proper development.

The greatest drawback of prematurity is that the bird seldom grows to a desired size or lays a good marketable egg, and consequently never makes a desirable breeder. The question of an export trade must always be kept steadily in view, and it is not the too early maturing bird that must be depended upon to produce the desired weight of egg demanded for this trade. Experience goes to prove that if we are to build up a sound oversea trade no egg under 2 oz. in weight should be shipped.

Reverting to the feeding and management of the pullets, it must not be inferred that the laying-period should be delayed by supplying a scant ration or one of inferior quality. The feeding of the pullets when nearing the laying-point cannot be too liberal, but it should be plain, consisting chiefly of good sound grain material and as much green stuff as they will eat. Where the danger lies is including in the ration too much rich food, such as milk, meat, or its substitutes. These foods tend to stimulate the reproductive organs before proper development has been attained. In a general way pullets should not be encouraged to lay before they reach an age of six months at the least. Even at this stage any forcing diet should be sparingly supplied, and increased by degrees as the birds develop.

ESSENTIAL ECONOMIES.

In these days of dear foodstuffs it is of the first importance that every ounce of food be utilized to the best advantage, for the purpose of reducing the cost of production. If broody hens, for instance, are allowed to sit on the nests for days at a time it will mean a continual drain on the profits of the poultry-keeper. This not only means a loss in eggs, but the breeding of insect pests is encouraged. Broody hens should be removed from the nest and placed in a broody-coop immediately they show the first desire to sit. It should be remembered that the longer the bird is allowed to sit on the nest the longer will it take to lose the broody fever, while, in addition, its failure to leave the nest to regularly take food and water will have the effect of lowering its vigour, which will consequently retard egg-production for a considerable period. Further, allowing a bird to remain on the nest for a long period is practically inviting an early moult. Many a good bird has been culled from the flock as an early moulter and a poor layer simply because it has been improperly handled during a broody period. The foolish practice of starving broody hens should be avoided; on the contrary, they should be given as much nourishing food as they will eat, in order that egg-laying may be resumed in the shortest time possible.

The day has gone by when it was considered that hens were all the better for a rest. Of course, birds which are being kept for laying purposes only are now referred to. I quite agree that birds which have been recently selected for next season's breeding-pens should be discouraged from laying to their extreme capacity. Such birds should have a good rest, to give them an opportunity of building up their vitality before being called upon to lay eggs for the renewal of stock.

In addition, where possible to do so, they should be specially marked, and placed on a good range by themselves. Then, by providing a more or less spare diet, or a frequent change of diet, and change of quarters, they will be discouraged from laying. In addition, such treatment, combined with the special exercising-space available, will tend to prevent them from becoming overfat at mating-time—a condition which is often responsible for the production of infertile eggs, poor hatches, and chickens that are difficult to rear.

Another expensive present-day leak is the food consumed by sparrows. The loss from this cause is considerable in normal times, but with the present high cost of food it must be a serious drain on the profits of those poultry-keepers who fail to guard against the nuisance. The only safe course to prevent this waste is to feed the poultry in the house at all times, care being taken that the open part of the front is covered with bird-proof wire netting. I have in mind several plants, both large and small, where the modern lean-to partly open-front house is adopted, in which the fowls are fed at all times, and yet sparrows take a heavy toll of food. This is because of the mistake made of using 2 in. mesh netting. Obviously this is false economy, as the food consumed by the small birds in probably a few weeks would cost more than removing the cause by replacing the large-mesh netting with a bird-proof size.

Especially will money be lost by holding on to old hens which have passed their best period of production. Obviously such stock must mean a constant drain on profits made by the younger birds. The same applies to keeping cockerels beyond the correct marketable age. If a cockerel is to show a profit over its keep it must be well fed from first to last, and marketed when from four and a half to five months old.

A form of false economy, especially when poultry-food is dear, is to underfeed the laying flock. It should be remembered that eggs are chiefly manufactured from the food eaten, and it is impossible for a hen to lay a 2 oz. egg day after day, and at the same time maintain her bodily health, if not supplied with an abundance of good nourishing food. Foodstuffs are certainly high in price, but so are eggs; and where only well-selected stock are kept they will yield a good profit over cost of production, provided, of course, that good management goes hand-in-hand with good feeding. The fact that food is dear does not imply that it should be given in less quantity, or that a poor-quality food should be supplied, but rather that all inferior stock should be culled out; while at the same time every endeavour should be made to use substitutes for dear grain, such as green food—preferably lucerne, clover, &c.—which can be grown and supplied in ample quantities.

In the past it has been possible for the poultry-keeper to make a profit while neglecting many important details of the business. If these weaknesses are now corrected the money thus saved will go a long way towards counterbalancing the increased cost of production caused by high-priced foodstuffs. In poultry-keeping it is the little things properly attended to which make all the difference between profit and loss. Very often the management may be correct to a great degree, but by not realizing what attention to small details really means the profits are consequently reduced.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

SHELTER.

As in the spring, a vital necessity at this time of the year is shelter for the hives. Brood-rearing must be encouraged if the bees are to go into winter quarters sufficiently strong to give good results the following season. If a shelter hedge or fence has not been provided, an excellent temporary breakwind of manuka scrub can be erected. Shelter without too much shade is the life of an apiary, and on no account should large trees be utilized as a means for protecting the hives. The spaces between the trunks are productive of draughts, and the high branches exclude too much of the sunlight. A line hedge, 8 ft. to 10 ft. high, is the ideal shelter for an apiary.

FOUL-BROOD.

The risk attendant on carrying over diseased bees is too great, as the trouble is more likely to be spread in the autumn and spring by robbing. In cases where weather conditions have prevented successful treatment, or in which foul-brood disease is detected on making a final examination prior to putting the bees into winter quarters, it is advisable to remove all combs showing the slightest signs of the disease. Where the disease is detected in a bad form nothing will be gained by holding the colony over for treatment, and it is much the safer plan to destroy it. In mild cases remove all the diseased combs and substitute clean drawn-out extracting-combs; provided plenty of capped stores are given, this will tide the colonies over until the spring. Mark all infected colonies as a reminder for early treatment. Avoid disturbing diseased hives in the off season, and guard against manipulations calculated to disturb the bees and induce robbing.

ROBBING.

Where the extracting has been completed in good time and every care taken to remove temptation from the bees' path there should be little or no danger from robbing. However, where the honey has been left in the hives till late in the season the act of opening the hives and removing the full combs is apt to arouse the bees' predatory instinct. On no account leave combs exposed one moment longer than necessary, either before or after extracting; carefully wipe any honey which may be spilled on wheelbarrow or any utensil in use at extracting-time, and see that every means of ingress into the disturbed hives is closed as soon as all manipulations are completed. Be sure the roofs are put on securely and that no robbers can crawl under them.

If robbing takes place in spite of all precautions, the apiarist should realize that he must take means to eradicate the trouble at once if he does not wish it to spread right through the apiary. He must realize that autumn robbing is very serious, and may tend to materially deplete his stocks before the bees settle down for the winter. The veriest tyro, by a little study of the entrance of a hive, can soon decide whether the colony is being robbed or not. Sometimes the young bees in their play-spell during the warm hours of

midday resemble, at a casual glance, a robber horde, but on closer examination the beekeeper will see that in such a case there is no struggle and consequent slaughter taking place at the hive entrance. Moreover, there will be a steady stream of workers in and out of the hive, intent on gathering the last of the failing honey-flow. Perhaps the surest indication of the well-being of a colony is the stream of pollen-bearers which every hive should have while the flowers last. If the apiarist sees the bees carrying in pollen without interruption he may conclude, whatever the excitement at the entrance, that the colony is not the victim of a hostile attack.

When robbing takes place in earnest perhaps the first indication the apiarist gets is in the noise the bees make. No other sound in an apiary is like it. It gradually develops into a steady purposeful roar, loud and aggressive, and in a short time the unfortunate colony will be assailed by a cloud of bees flying steadily at the hive, fighting with the inmates and with each other, and strewing the ground with the dead and dying. The beekeeper should at once contract the entrance of the hive until only two bees can escape at once. He should then pile wet grass high over the alighting-board, completely covering the entrance, and the grass must be kept wet. The bees outside will not force their way through the wet grass, and by the time those inside escape they will be glad enough to get out and stay out.

If bees persistently hang round a hive it is well to examine it as quickly and thoroughly as possible. Bees seem to have some uncanny instinct which tells them when a hive is weak or queenless, and if they persistently hover round one particular colony it is usually a warning to a beekeeper that all is not well inside. On examination the colony will usually prove to warrant removal and uniting with one stronger and better able to guard itself. If a colony of this kind has to be opened, any frames which are removed must be kept covered with the carbolized cloths useful at extracting-time.

One other matter to which the beekeeper should give his attention when the bees are inclined to rob is the protection of his honey-house. The windows should be provided with bee-escapes, so that all intruders may easily be removed, but on no account must there be any holes through which they can re-enter. Bees robbing a hive are bad enough for any beekeeper, but bees robbing a honey-house are like all the wild animals in a menagerie let loose, and the beekeeper who once allows this state of things to happen will usually reap his reward in the shape of innumerable stings from his infuriated subjects.

—*E. A. Earp, Senior Apiarist.*

HORTICULTURE.

VEGETABLE-GROWING.

THE mild climate of New Zealand permits, with few exceptions, the sowing of crops during the greater part of the year. In a well-drained, sheltered spot onion seed-beds should now be sown (if not already done) for planting out in spring—that is, where autumn

sowing of the main crop is necessary. In any case a sowing of the large mild white Italian onions made now will be ready for harvesting in spring and early summer, when they are in great demand for salads.

Warm, sheltered slopes where the soil is good may be sown down in dwarf green peas for a first early crop.

Also seed-beds may be made and sown with main-crop cabbage, cauliflower, and cabbage lettuce, the intention being to allow these plants to stand over for planting out in early spring. For this purpose sow rather thinly. Cauliflower and cabbage for early spring cutting should now be planted out from seed-beds into a piece of good well-drained land.

Complete earthing up the celery crop. Cut down the asparagus growth level with the ground as soon as it ripens and before the seed falls.

Harvest potatoes, onions, pumpkins, &c., as they mature. Remember the keeping-qualities largely depend on how this is done. Pumpkins are best cut and allowed to remain for a while as they grew before gathering them. They should then be stored in a dry, airy place.

GREEN-MANURING.

Idle land is much inclined to become infested with bad weeds and sour conditions before a good natural herbage becomes established. Economical management demands that it should be taken in hand as soon as a crop is harvested.

The increase in the use of motor-vehicles does not appear to have much special connection with horticulture, but the truth is it is causing a fundamental change in practice. In the past the usual method at this season as soon as a crop was harvested was, under some circumstances, to plough in a heavy dressing of stable manure by way of preparing the land for the next crop, and with cheap supplies this was a quick and efficient method of reconditioning land. Unfortunately, that supply has now passed, and while chemical fertilizers to some extent supply the need, they do not afford the humus and fibre that were supplied to the land by stable manure. These valuable ingredients are now obtained by sowing the land to be treated with a green cover-crop, and, when mature, ploughing it in and allowing it to decay—a slow method which in the case of valuable land is a serious cost, as the time could otherwise be devoted to growing a marketable crop. For this reason many growers are inclined to starve the land for want of these supplies.

Experience will doubtless improve our methods in this direction, but meanwhile it is necessary to see that each area has reasonable attention of this kind periodically. By selecting cover-crops of a hardy nature they may be grown during the winter, when the land can best be spared from growing crops that are directly marketable. At this season, as soon as a market crop is harvested, disk or harrow down the land and sow a hardy green crop. The fertilizers in the ground will soon assist it to make a strong growth, which will keep the land clean, and mature in time to be turned in and decay before the spring planting. With the proper use of lime dressings this method can be relied upon to greatly assist in keeping the soil in good order.

TOMATO GLASSHOUSES.

Tomato glasshouses will yield a good crop all the easier next season if they are well cleaned up now as required. Where insect or fungus troubles have been epidemic during the season, or have shown a tendency to become so, the present time affords the best opportunity of dealing with it. In such cases clean up the house and land well, and sow down the latter with a suitable green cover-crop, leaving ample ventilation on.

SMALL-FRUITS.

The preparation of land intended for a strawberry crop should now be completed, and delivery obtained of the plants as soon as they are available. When they arrive, open up the bundles and air them. Trim up the roots and tops, and set out the plants as soon as the weather and the condition of the ground permit. This operation is facilitated if a fine, even, firm surface is first obtained. It is important to plant only varieties proved suitable to the locality, and to obtain the plants from a supplier with a reputation for careful selection. Experiments with new varieties are important, but they should first be tried on a small scale only.

Land to be planted out in bush fruits should now receive attention. Most of these plants have fibrous roots near the surface, which preclude deep cultivation after planting. For this reason deep and thorough preparation is necessary now. Place the order for plants without delay; supplies of this kind are usually short. Obtain delivery as soon as the plants are ready for lifting, and heel them in carefully; they will then be ready for planting out when required.

WALNUTS.

The season has been a good one for walnuts in most districts. This valuable crop is worth careful attention. Too often the local sample compares badly with the imported nuts, although their intrinsic value is appreciated by the consumer. With a little more attention in harvesting, the local nuts might obtain a decided preference on the market. Gather the nuts as soon as there is a fair picking on the ground, and thus avoid stained shells. It is of some assistance to shake the branches with a long boathook-like implement. Sweet, well-flavoured kernels are obtained by thorough curing. For this purpose the nuts may be spread on shallow trays and thoroughly dried, going through them occasionally and turning them over. Avoid drying them too quickly in a hot sun, or nuts that are poorly sealed will open. Afterwards shake them in wire riddles of a suitable size to dispose of small nuts and litter, and finally pick them over, removing broken and blighted nuts, also those with husks adhering. They have then only to be bagged up ready for marketing.

—W. C. Hyde, Horticulturist.

Dairy Farm Instructors.—The most recent appointment of an Instructor is to a group of three dairy companies in the Nelson District. In the Manawatu two butter- and two cheese-making companies have recently combined for the services of an Instructor, and several other companies are awaiting opportunity to join existing groups for the same purpose.

WEATHER RECORDS: FEBRUARY, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE month was remarkably cool, the temperature showing the lowest February mean for fourteen years. Two or three very cold nights were experienced, and some light frosts, which are most unusual, occurred in places widely apart.

The daily weather charts for the first half of the month disclosed the existence of three considerable areas of low pressure off the east coast of the South Island. These accounted for the strong southerly winds which prevailed, and resulted in heavy rains and cold weather, particularly in the South. The total rainfalls in Otago were from 100 to 200 per cent. above the average for the month in previous years, and the weather was altogether unseasonable, being the wettest February for thirty years. Rainfall was, however, from 50 to 60 per cent. below the mean about Nelson and Collingwood, in the north-western districts of the South Island. Rainfall was also from 40 to 60 per cent. below the average in most parts of the North Island; but Kawhia, Wanganui, and Foxton were exceptions, reporting falls above the mean.

The latter half of the month, though very changeable, was more equable, except for a "southerly buster" between the 27th and 28th. This brought welcome rain in Hawke's Bay, which, however, still suffers from the general dryness that has persisted there during the past six months.

—*D. C. Bates, Director.*

RAINFALL FOR FEBRUARY, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	0·50	6	0·16	2·95
Russell	2·48	4	1·04	4·35
Whangarei	0·74	6	0·28	4·95
Auckland	2·57	16	0·84	3·06
Hamilton	1·85	15	0·68	2·85
Kawhia	3·76	13	0·94	2·40
New Plymouth	3·46	13	0·62	4·01
Riversdale, Inglewood	4·52	14	1·22	5·30
Whangamomona	3·88	14	0·96	4·14
Tairua, Thames	0·96	8	0·50	4·52
Tauranga	1·01	7	0·36	3·58
Maraehako Station, Opotiki ..	1·84	8	0·64	3·70
Gisborne	2·17	10	0·60	3·63
Taupo	1·52	5	0·96	2·81
Napier	1·50	9	0·40	2·92
Maraekakaho Station, Hastings ..	1·24	9	0·32	2·52
Taihape	3·76	13	0·78	2·52
Masterton	4·06	12	0·79	2·70
Patea	1·94	11	0·54	2·33
Wanganui	4·39	11	1·05	2·49
Foxton	2·59	5	1·60	1·71
Wellington	2·63	9	0·83	3·20
South Island.				
Westport	5·35	18	1·58	4·37
Greymouth	6·84	16	1·20	6·13
Hokitika	10·12	17	2·14	7·20
Ross	10·84	15	2·68	8·45

RAINFALL FOR FEBRUARY, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Arthur's Pass	12.74	16	2·75	7·55
Okuru, Westland	15·52	15	2·84	7·92
Collingwood	2·22	15	0·54	5·63
Nelson	1·38	8	0·49	2·77
Spring Creek, Blenheim ..	2·63	8	0·95	2·30
Tophouse	3·89	13	1·30	4·50
Hanmer Springs	4·98	12	1·12	2·93
Highfield, Waiau	3·86	10	1·17	2·59
Gore Bay	3·60	12	1·57	3·50
Christchurch	2·79	12	1·44	1·77
Timaru	2·98	13	1·12	1·89
Lambrook Station, Fairlie ..	4·01	9	1·58	1·95
Benmore Station, Omarama ..	2·80	11	0·90	1·23
Oamaru	5·29	13	1·65	1·72
Queenstown	4·58	17	1·49	1·76
Clyde	2·34	12	0·88	0·99
Dunedin	6·98	21	1·17	2·69
Wendon	5·58	18	1·18	1·57
Gore	4·83	22	0·92	2·47
Invercargill	6·22	22	0·70	2·68

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 31st December, 1925, to 25th February, 1926, include the following of agricultural interest:—

No. 52651: Phosphate-rock-grinding process; A. A. Adams, Auckland. No. 52967: Sheep-bearing appliance; W. H. Taylor, Hastings. No. 53128: Flax bleaching and drying; S. H. Maddren, Christchurch. No. 53351: Milk and cream cooling; L. Hansen, Christchurch. No. 53552: Tractor-control; H. W. Johnson, Dunsandel. No. 54043: Sheep-shears; H. Norman, Pembroke. No. 54606: Milking-machine teat-cup-cleansing means: T. Shiels, Invercargill. No. 54926: Incubator and brooder; H. A. Dawber, Ouruhia. No. 55089: Tractor and plough hitch; P. M. Heffernan, Palmerston South. No. 52727: Cattle-choking prevention; R. K. Phelps, Tauranga. No. 53150: Concrete fencing-post; E. Andersen, Midhirst. No. 53322: Branding-device; W. C. Haynes and C. W. Pickles, Hastings. No. 53964: Fumigating apparatus for animal-destruction; W. F. Lange and T. H. Varcoe, Mount Gambier, S. Australia. No. 54776: Milking-machine; Clark and Fauset, Ltd., Brisbane. No. 54987: Flax-dressing method; F. T. F. Evans, Auckland. No. 55185: Milking-machine pulsator; A. W. Reid, Stratford. No. 55251: Harrow; H. S. Pearson, Springston. No. 55274: Concrete fencing-post; A. D. Brown, Eskdale. No. 55277: Milking-machine pulsator; R. B. Forsyth, Christchurch. No. 55373: Sugar-of-milk manufacture; J. Chism, Edendale. No. 55438: Tractor-wheel; W. J. Smith, Warracknabeal, Victoria. No. 53781: Shovel; W. Hooper, Cromwell. No. 55502: Milk-powder oxygen-content-reducing process; Merrell-Soule Co., Syracuse, U.S.A. No. 55506: Milk-can sterilization; C. E. Gray, Oakland, California. No. 52676: Milk and cream treatment; F. L. Armitage, Auckland. No. 53027: Flax-stripper feed-rollers; A. Thomson and C. E. Petersen, Bull's. No. 55566: Cow-udder sprayer; A. Smith, Tauranga.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price 1s.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

ANGORA GOATS.

"SUBSCRIBER," Tahora :—

Could you let me have the following information concerning Angora goats: Whether they compare favourably with dry crossbred sheep on rough country as a source of income; whether there is a heavy death-rate or not; what price the wool fetches, and how much they clip; does a goat prefer herbaceous foods to grass?

The Live-stock Division :—

Angora goats can never compare with sheep as a source of income. With ordinary care and attention to feed, the Angora goat is a healthy animal, and mortality from disease is low. Angoras clip from 2½ lb. to 3 lb. The quantity of mohair offered in New Zealand is small, but a market always exists. The ruling price on the local market is 9d. or 10d. per pound. This does not refer to first quality, however, for which a higher price is obtained. Although a goat consumes a quantity of rough herbage, it cannot be said that this animal does not like grass, and in successful goat-keeping a change on to good pasture occasionally is essential to maintain the animals in healthy condition. It is because of neglect of this point that goat-keeping has so often proved a failure.

BASIC SUPERPHOSPHATE.

H. FORSTER, Mercer :—

Will you kindly let me know if there is any standard for mixing basic super? What percentage of lime should be added, and what kind—burnt or carbonate?

The Fields Division :—

Basic superphosphate, as supplied by fertilizer-manufacturers, consists of a mixture of superphosphate and burnt lime; 15 per cent. of burnt lime is added to the superphosphate, mixed thoroughly, and allowed to stand for twenty-four hours while heating takes place. Mixtures of superphosphate and ground limestone in varying proportions, as made by farmers, are often wrongly called basic superphosphate. They are in reality mixtures of carbonate of lime and super, the phosphate being rendered less soluble than in basic superphosphate.

HORSES WITH SORE SHOULDERS.

S. B., Waharoa :—

We are having a lot of trouble with two of our horses; they are continually breaking out in sores on the wither underneath the flaps of the collar. Before we took them over they were worked with too small a collar. We got new collars for them, but their necks are no better. We have cut the hair off, and bathed the sores and dressed them with gall cure, and we tried vaseline and Safonia mixed together, but it seems to make no difference. Would you kindly advise as to the best treatment?

The Live-stock Division :—

Sore shoulders in horses is usually the result of wearing a badly-fitting collar, or allowing the collar to get hard from the accumulation of sweat and dirt becoming dry upon it, also from not keeping the skin of the animal clean where the collar rests. A collar too small or too large will cause trouble, and also allowing horses, especially young animals, to work hard before they are used to it. Some horses, however, are very difficult to keep whole, and these require careful fitting of the collar, and attention. The condition of the animal has also an important bearing. A careful saddler will provide a well-fitting collar, and that must be kept clean. If the animal has been sweating, and it is necessary to stand for

some time, it is advisable to raise the collar and allow the air to get at the shoulders, and see that the mane is not under the collar. After work, bathe the shoulders with a solution of common salt and cold water—two tablespoonfuls to the gallon—and apply the following lotion to the sores: Zinc sulphate, 1 oz., and lead acetate, 1 oz.; put into an ordinary quart bottle, and fill with camphor water or cold water. Before applying, shake the bottle well, and label it "Poison." A saturated solution of alum and water is useful applied to the shoulders after removal of collar after work. If the shoulders are bad, one must allow the wounds to heal before using the collar again, or have the sores protected from friction by judicious padding if the animal is kept at work. If this can be done it has the advantage of preventing the shoulders from becoming soft and out of condition. Sometimes it is necessary to resort to the use of breast harness instead of a collar.

DESTRUCTION OF RAGWORT.

"RAGWORT," Horotiu:—

Kindly let me know if there is a definite thing to destroy ragwort. Could you suggest a chemical or an acid to apply to the roots? We have only about a dozen plants on the place, which are dug out every year, but in spite of what we do they repeatedly grow again next year.

The Live-stock Division (Noxious Weeds Inspection):—

Where only a few scattered plants exist—the nucleus of a countryside pollution—the best possible method of destruction is to pull or dig them up by the roots, and burn the pulled growths to prevent the resowing of the land by the seed, which will ripen if the plant is simply pulled and let lie. Possibly this may be partly the reason for the seasonal recrudescence you mention, for while the flowering growths that are removed are in their season of maturity those in the first stages of development that come to fruition in the following year are possibly overlooked. It therefore becomes essential that the action suggested, to be effective, be continued over the full periods of development and maturity. No chemical application is recommended if the procedure stated is adopted.

DANTHONIA GRASSLAND.

J. C., Aranga, Northern Wairoa:—

Will you kindly give me some information on danthonia-grass? I have got about 300 acres in danthonia (just bought the farm), and have no experience with this grass. The land here is light gum land; it dries up very easily. I have 200 acres still in fern, and should be glad to have your opinion about danthonia before I put this area in grass.

The Fields Division:—

Of the two danthonia species, *D. pilosa* and *D. semiannularis*, the former, on account of its close turf-forming properties and higher palatability, is the one generally advised for sowing on the poorer types of fern and manuka country, especially where the soil is light and tends to dry out in the summer. In such places *Danthonia pilosa* is the most valuable grass we have for giving the necessary cover to compete with the secondary growth, and has the advantage that it will stand fire, and can thus be used for carrying a fire through such growth. *Danthonia semiannularis*, which has longer leaves and generally gives a larger amount of this dry herbage in the summer, is more suitable for the purpose of cleaning up land by fire, but this advantage is outweighed by the better feeding and turf-forming properties of *Danthonia pilosa*.

With regard to burning off, as already stated, danthonia tends to run away to dry growth in the summer, and this growth, together with the young fern or manuka, can be burnt off. If the growth is fern, it should be burnt in the late autumn, about the end of March or April. Where manuka is coming back it is better to burn off in the early spring. This can be done only when very light stocking is done during the winter and the dry growth saved for the burn. A few seasons of burning off should suffice to kill the fern or manuka and form a pure danthonia pasture. Such a pasture tends to get away each year, and becomes unpalatable to sheep and indigestible to lambs. The usual practice is then to

burn this growth about February or March, when the danthonia comes away rapidly, providing succulent green feed. Such burning is wasteful of nitrogen. A better practice is to stock with cattle during the autumn and winter, following the cattle with sheep. The cattle can handle the dry stuff, and leave the pastures short and sweet for the sheep in the spring.

In the North paspalum is largely taking the place of danthonia, except on the higher and drier slopes where it cannot compete with danthonia. With regard to your 200 acres in fern, we would therefore advise you to sow with the danthonia 4 lb. to 6 lb. of paspalum per acre, after burning off the fern in the autumn. Both of these grasses are slow to establish, and it is necessary to add a mixture of temporary grasses and clover to the permanent portion. A suitable mixture for surface sowing per acre would be: Italian rye-grass, 3 lb.; perennial rye-grass, 6 lb.; red clover, 2 lb.; Danthonia pilosa, 6 lb.; paspalum, 4 lb.; brown-top, ½ lb.; Lotus hispidus, 1 lb.; Lotus major, ½ lb. Disking before sowing is a great advantage—in providing a seed-bed—and should be practised when possible.

After clearing an area of fern and manuka by burning off danthonia it is possible to raise the fertility by means of top-dressing and the surface sowing of clovers such as white clover, red clover, and Lotus major, so that cocksfoot, crested dogstail, and perennial rye will thrive and gradually take the place of the danthonia. On small areas it is more profitable to so raise the fertility by top-dressing than reduce it by continually burning off danthonia and paspalum for the sake of the succulent feed. Danthonia, paspalum, and brown-top must be relied upon to give the maximum growth on the poorer classes of soils where the better grasses do not thrive.

IMPORTATION OF GRAPES OR GRAPE-VINES.

THE regulations under the Orchard and Garden Diseases Act governing the importation of grapes or grape-vines into New Zealand have been amended as from 4th March.

Clause 3 of the principal regulations is revoked, and the following substituted: Grapes may be introduced into New Zealand from Australia, or from the Dominion of Canada or the United States of America, provided that every shipment of grapes must be accompanied by a certificate as set out in Form No. 1 of the Third Schedule hereto, signed by the shipper, setting forth the number and kind of packages, the shipping-marks, the name of the grower of such grapes, the locality of the vineyard, and the State or province where such grapes were grown, and certifying that no downy mildew or phylloxera is known to exist within five miles of the vineyard where such grapes were grown, that no grape-vine foliage or wood is attached to such grapes, that no grapes from any other vineyard than the one specified as aforesaid have been mixed with the consignment, and that such grapes are contained in clean, new packages not previously used for any purpose; also by a certificate, as set out in Form No. 2 of the Third Schedule hereto, signed by an officer of the Department of Agriculture in the State or province where such grapes were grown, certifying that such grapes are clean and free from disease, that no downy mildew or phylloxera is known to exist within five miles of the vineyard where such grapes are certified by the shipper to have been grown, and that no grape-vine foliage or wood is attached to such grapes.

Clause 7 is similarly revoked, and the following substituted: The introduction into New Zealand of grape-vines or portions thereof, except grapes, is prohibited, save that the Director of the Horticulture Division, Department of Agriculture, may, with the prior consent of the Minister of Agriculture, import grape-vines or portions thereof of special varieties.

The amended regulations, including the Third Schedule referred to above, are published in full in the *New Zealand Gazette* of 4th March, 1926.

New Rabbit-proof Fencing District.—The constituting of the Motunau Rabbit-proof Fencing District, North Canterbury, for the purposes of Part IV of the Rabbit Nuisance Act, is published in the *Gazette* of 25th February; also consequential alterations in the boundaries of the Hurunui Rabbit District.

THE REGINALD MacKINNON PRIZE.

THE late Reginald Mackinnon, a resident of Southland and formerly a runholder, bequeathed his property to be held in trust and used in perpetuity for public purposes, one-fourth of the income being for the encouragement of agriculture in Southland in particular and New Zealand in general, the latter by means of a prize for essays on agriculture written in New Zealand. Regulations have been recently issued by the trustees providing for and governing an annual prize for an essay on some subject bearing on the agriculture of New Zealand.

The scheme will also include a bursary of £30 to be held by a Southland pupil who intends to study agriculture in one of the New Zealand colleges. Other portions of the available income will be allotted to agricultural and similar associations in Southland as prizes for shows. In all about £400 a year will be applied to the foregoing purposes.

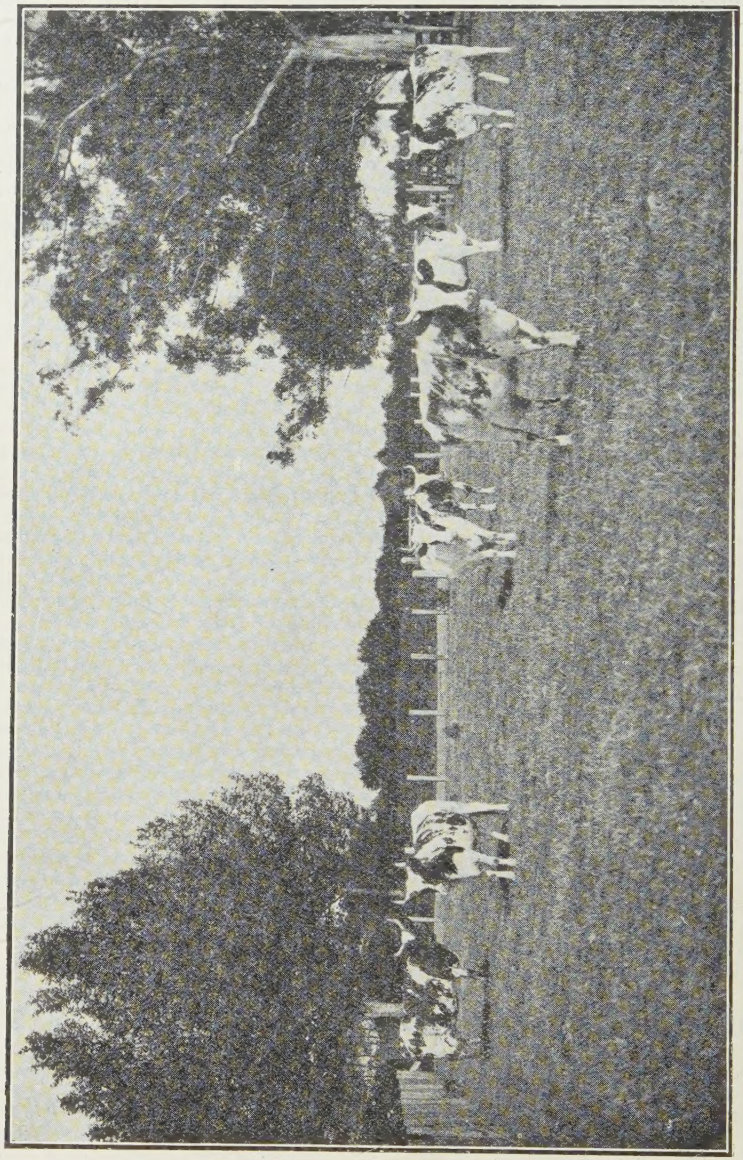
The prize for the above-mentioned essay will be awarded under the following conditions :—

(1.) The prize shall be known as the Reginald MacKinnon Prize. (2.) The object of the prize is to stimulate the search for, and distribution of, knowledge calculated to improve the practice of agriculture in New Zealand. (3.) The prize will be awarded for excellence in an essay, which, together with a precis of its contents, shall be forwarded to the trustees before 1st September in each year. (4.) The essays will be handed to two or more judges, who will be asked to determine if any of the essays is worthy of the prize, and, if so, which one. (5.) The writer of any essay entered for competition must have been a resident of New Zealand for the three years immediately preceding that in which he presents his essay. (6.) If the essay recommended for the prize has not been published before being entered for the competition it shall be published by the successful competitor before the prize is presented. (7.) No material part of the essay shall have been published for more than a year before it is entered for competition. (8.) Essays written as theses for university degrees, or as reports on investigations undertaken for remuneration, are not debarred from competing for the prize, but the judges will give less weight to such essays than to others of comparable merit. (9.) Only one prize (if any) shall be awarded in one year, but the judges may recommend that various consolatory sums be paid to unsuccessful candidates. Whether a prize be awarded or not in any year, the consolatory sums shall not total more than one-fourth of the funds available for the purposes concerned in these regulations for that year. (10.) The award of the judges shall be final and cannot be appealed against. (11.) The sum available for the prize will be expended by the trustees in part on a medal, or some other permanent record for presentation to the winner, and £50 in a cash payment. (12.) The sum available for the prize and any consolatory sums, as mentioned in clause 9, will be about £60 per annum. (13.) Whenever convenient, the trustees will arrange for the prize to be presented in some public manner.

The judges for the year 1926 will be the Director of Canterbury Agricultural College, Lincoln, and the Professor of Agriculture at Victoria College, Wellington. Essays should be sent by registered post, addressed "Trustees, Reginald MacKinnon Trust, 39 Esk Street, Invercargill." The trustees are Messrs. J. L. McG. Watson and C. Gilbertson.

IMPORTATION OF FERTILIZERS: DECEMBER QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 31st December, 1925 :—*Sulphate of Ammonia :* From United Kingdom, 35 tons; Australia, 39 tons. *Nitrate of Soda :* United Kingdom, 1 ton; Chile, 760 tons. *Basic Slag :* United Kingdom, 564 tons; Belgium, 85 tons. *Bonedust :* Australia, 10 tons. *Phosphates :* Nauru Island, 7,031 tons; Ocean Island, 12,114 tons; New Caledonia, 4,988 tons. *Kainit :* United Kingdom, 30 tons; Belgium, 24 tons; France, 116 tons; Germany, 485 tons. *Muriate of Potash :* Germany, 5 tons. *Sulphate of Potash :* United Kingdom, 51 tons; France, 101 tons; Germany, 67 tons. *Potash, other :* United Kingdom, 95 tons; France, 326 tons; Germany, 365 tons. *Sulphate of Iron :* United Kingdom, 2 tons; Australia, 21 tons.



SOME OF THE AYRSHIRE HERD AT RUAKURA FARM OF INSTRUCTION.